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**INTERIM TEST RESULTS REPORT FOR
HURLBURT FIELD FIRE TRAINING AREA (SITE FT-39)
EGLIN MAIN OLD FIRE TRAINING AREA (SITE FT-28)
EGLIN AFB, FLORIDA**

Prepared For

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August 1994

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INTERIM TEST RESULTS REPORTS FOR HURLBURT FIELD FIRE TRAINING AREA (FT-39) EGLIN MAIN OLD FIRE TRAINING AREA (FT-28) EGLIN AFB, FLORIDA

An initial bioventing pilot test was performed at the Hurlburt Field Fire Training Area (FT-39) and the Eglin Main Old Fire Training Area (FT-28), Eglin AFB, Florida during the period of March 14, 1994 to March 24, 1994. The purpose of this Part II Report is to describe the results of the initial pilot tests and to make specific recommendations for extended testing to determine the long-term performance of bioventing in remediating site contaminants. Descriptions of the history, geology, and site contaminants are contained in the Test Work Plan (ES, 1993).

1.0 PILOT TEST ACTIVITIES

1.1 Hurlburt Field Fire Training Area (FT-39)

1.1.1 Pilot Test Design and Construction

In accordance with the Test Work Plan, one vertical air injection vent well (VW) and three multiple-depth soil vapor monitoring points (MPs) were installed the week of February 28, 1994. A 1.0-horsepower regenerative blower was installed at the VW to provide the necessary air for bioventing. Figure 1.1 depicts the locations of the VW, MPs, and blower at the FT-39 site. Figure 1.2 depicts the vertical hydrogeological cross section around FT-39. The following sections describe in more detail the final design and installation of the bioventing system.

1.1.2 Vent Well Construction

The VW was installed on March 1, 1994 in an area of documented high TPH contamination. The VW was constructed of 4-inch diameter Schedule 40 PVC with a slot size of 0.04 inches. The total depth of the VW was 8.0 feet below ground surface (bgs), with a screened interval from 8.0 to 3.0 feet bgs. The annular space between the well casing and the borehole was filled with 6-9 silica sand from the bottom of the boring to approximately 2.5 feet bgs. Granular bentonite was placed above the sand pack from 2.5 feet bgs to 1.5 feet bgs and hydrated in place with potable water. The VW was finished with 0.5 foot layer of sand upon which a 12-inch flushmount protective well cover was cemented in place with approximately 1 foot of cement/bentonite grout. A detail of the VW construction is presented on Figure 1.3.

1.1.3 Soil Vapor Monitoring Points

Three soil MPs were installed at 10, 20 and 40 feet radially away from the air injection vent well. Each MP was constructed to provide multiple depth soil gas

monitoring with two discrete sample points at 3.5 to 4 feet and 5.5 to 6 feet bgs. A small variation to this sampling interval was made at the outermost MP because of changes in elevation. Each discrete point was constructed of a six-inch long piece of 1/2-inch diameter Schedule 40 PVC well screen with 0.02 slot size. The riser of each discrete point was constructed of 1/2-inch Schedule 80 PVC, which extended to approximately six inches bgs.

Clean 6-9 silica sand was placed around each discrete point to provide a filter pack between the borehole wall and the point. Granular bentonite was placed both below and above each discrete point to provide an air tight seal between the points. The bentonite was placed in 12-inch lifts and hydrated in place to assure the proper seal. The top of each discrete point riser was fitted with a 1/4-inch quarter turn ball valve and 3/16-inch hose barb to allow for connection of appropriate monitoring instruments.

Additionally, Type K thermocouples with mini connectors were installed at the 4 feet and 6 feet bgs discrete monitoring points in the MP closest to the VW (MPA). These thermocouples will be used to measure the temperature profile at the site. The top of each MP was completed with a 12-inch flush mounted protective well cover set in a concrete base. Figure 1.4 shows the construction of the soil vapor monitoring points.

1.1.4 Blower Unit Installation

A one-horsepower GAST® regenerative blower unit was installed at FT-39 for the initial and extended pilot tests. The blower was installed in a weather resistant enclosure and electrically wired for permanent 240-volt, 30-amp service. Air from the blower is injected into the vent well via a two inch PVC line connected to the blower's exhaust port. A diagram of the blower unit and installation is presented on Figure 1.5.

1.2 Eglin Main Old Fire Training Area (FT-28)

1.2.1 Pilot Test Design and Construction

In accordance with the Test Work Plan, one vertical VW and three multiple-depth MPs were installed the week of February 28, 1994. A one-horsepower regenerative blower was installed at the VW to provide the necessary air for bioventing. Figure 1.6 depicts the locations of the VW, MPs and blower at the FT-28 site. Figure 1.7 depicts the vertical hydrogeological cross section around FT-28. The following sections describe in more detail the final design and installation of the bioventing system.

1.2.2 Vent Well Construction

The VW was installed on March 1, 1994 in an area of documented high TPH contamination. The VW was constructed of 4-inch diameter Schedule 40 PVC with a slot size of 0.04 inches. The total depth of the VW was 40 feet below ground surface (bgs), with a screened interval from 5 to 40 feet bgs. The annular space between the well casing and the borehole was filled with 6-9 silica sand from the bottom of the boring to approximately four feet bgs. Bentonite chips were then placed above the sand pack in one foot lifts to a depth of two feet bgs. Each lift of bentonite chips was hydrated in place with potable water. A 1.0 foot layer of sand was placed above the bentonite. The VW was finished with a one foot layer of cement/bentonite grout above the sand and

around a 12-inch flushmount protective well cover. The well cover was cemented in place with the cement/bentonite grout. A detail of the VW construction is presented on Figure 1.8.

1.2.3 Soil Vapor Monitoring Points

Three MPs were installed at 10, 20 and 40 feet radially away from the air injection vent well. Each MP was constructed to provide multiple depth soil gas monitoring with three discrete sample points at 4.5 to 5, 25.5 to 26 and 38.5 to 39 feet bgs. Each discrete point was constructed of a six-inch long piece of 1/4-inch diameter Schedule 40 PVC well screen with 0.02 slot size. The riser of each discrete point was constructed of 1/2-inch Schedule 80 PVC, which extended to approximately six inches bgs.

Clean 6-9 silica sand was placed around each discrete point to provide a filter pack between the borehole wall and the point. Granular bentonite was placed both below and above each discrete point to provide an air tight seal between the points. The bentonite was placed in 12-inch lifts and hydrated in place to assure the proper seal. The top of each discrete point riser was fitted with a 1/4-inch quarter turn ball valve and 3/16-inch hose barb to allow for connection of appropriate monitoring instruments.

Additionally, Type K thermocouples with mini connectors were installed at the 39 feet and 5 feet bgs discrete monitoring points in the MP closest to the VW (MPA). These thermocouples will be used to measure the temperature profile at the site. The top of each MP was completed with a 12-inch flush mounted protective well cover set in a concrete base. Figure 1.9 shows the construction of the soil vapor monitoring points.

1.2.4 Blower Unit Installation

A 1.0-horsepower GAST® regenerative blower unit was installed at FT-28 for the initial and extended pilot tests. The blower was installed in a weather resistant enclosure and electrically wired for permanent 240-volt, 30-amp service. Air from the blower is injected into the vent well via a two inch PVC line connected to the blower's exhaust port. A diagram of the blower unit and installation is presented on Figure 1.5.

Prior to departing the site, the ES engineer provided an operations and maintenance briefing, O&M checklist, and blower maintenance manual to the base point of contact.

2.0 PILOT TEST SOIL AND SOIL GAS SAMPLING RESULTS

2.1 Hurlburt Field Fire Training Area (FT-39)

2.1.1 Soil and Soil Gas Sampling Results

Soils at the FT-39 site consist of fine to medium brown sands. This soil profile was consistent throughout the unsaturated zone and to approximately five feet below the groundwater surface which was encountered at approximately 8 feet bgs.

Hydrocarbon contamination at the site appears to extend from the ground surface to the groundwater table. Contaminated soils collected by split spoons during the VW and MP installations were identified based on visual appearance, odor and photoionization detector (PID) screening. Varying degrees of hydrocarbon staining were encountered

throughout the vertical profile in the unsaturated soil zone, and light to strong hydrocarbon odors were noticed in nearly all the split spoon samples. PID readings of greater than 20,000 ppm were measured in a number of soil samples.

Soil samples for laboratory analysis were collected in brass liners inserted into stainless steel split spoons during the VW and MP installations. Procedures for soil sample collection specified in the Protocol Document (Hinchee, et. al., 1992) were followed for all sample collections. Samples were collected from the 6 to 8 feet interval from the VW, from the 3 to 5 feet interval in MPA, and from the 5 to 7 feet interval in MPB. All split spoon samples were screened for VOCs by use of the PID to determine the presence of hydrocarbon contamination and to select samples for laboratory analysis.

Soil gas samples were collected prior to performing the air permeability test in laboratory provided, evacuated Summa® canisters. Soil gas samples were collected from the VW, the 3.5 to 4 feet bgs discrete monitoring point at MPA, and from the 3.5 to 4 feet bgs discrete monitoring point in MPC. All soil gas samples were collected following procedures in the Protocol Document.

The soil samples for laboratory analysis were placed on ice and shipped via Federal Express® to the PACE Inc., Laboratory in Huntington Beach, CA. Each soil sample was analyzed for total recoverable petroleum hydrocarbons (TRPH); benzene, toluene, ethylbenzene, and total xylenes (BTEX); iron; alkalinity; total Kjeldahl nitrogen (TKN); pH; phosphates; percent moisture; and grain size distribution. Soil gas samples were placed in a shipping box (without ice), and shipped via Federal Express® to Air Toxics, Inc., in Folsom, CA for total volatile hydrocarbon (TVH) and BTEX analysis. The analytical results for these soil and soil gas samples are presented in Table 2.1.

2.1.2 Exceptions to Test Protocol Document Procedures

There were no exceptions to the Test Protocol Document procedures.

2.1.3 Field QA/QC Results

Field quality assurance/quality control (QA/QC) samples were not collected or required at this site because the ten percent collection requirement for QA/QC duplicate samples has been met at other AFCEE bioventing test sites.

2.2 Eglin Main Old Fire Training Area (FT-28)

2.2.1 Soil and Soil Gas Sampling Results

Soils at the FT-28 site consist mainly of medium to coarse tan and dark yellowish brown to reddish brown sand. This soil profile included poorly to well graded sand with trace silt and trace gravel intermittently throughout the unsaturated zone to approximately 39 feet where groundwater was encountered.

Hydrocarbon contamination at the site appears to extend from the ground surface to the groundwater table. However, at depths between 15 to 30 feet evidence of contamination was minimal. Contaminated soils collected by split spoons during the VW and MP installations were identified based on visual appearance, odor and PID screening.

Varying degrees of hydrocarbon staining were encountered throughout the vertical profile in the unsaturated soil zone, and light to strong hydrocarbon odors were noticed in nearly all the split spoon samples. PID readings of greater than 20,000 ppm were measured in a number of soil samples.

Soil samples for laboratory analysis were collected in brass liners inserted into stainless steel split spoons during the VW and MP installations. Procedures for soil sample collection specified in the Protocol Document (Hinchee, et. al., 1992) were followed for all sample collections. Samples were collected from the 3 to 5 feet interval from the VW, from the 37 to 39 feet interval in MPA, and from the 2 to 4 feet interval in MPB. All split spoon samples were screened for VOCs by use of the PID to determine the presence of hydrocarbon contamination and to select samples for laboratory analysis.

Soil gas samples were collected prior to performing the air permeability test. These samples were collected in laboratory provided, evacuated Summa® canisters. Soil gas samples were collected from the VW, the 4.5 to 5 feet bgs discrete monitoring point at MPA, and from the 38.5 to 39 feet bgs discrete monitoring point in MPC. All soil gas samples were collected following procedures in the Protocol Document.

The soil samples for laboratory analysis were placed on ice and shipped via Federal Express® to the PACE Inc., Laboratory in Huntington Beach, CA. Each soil sample was analyzed for TRPH; BTEX; iron; alkalinity; TKN; pH; phosphates; percent moisture; and grain size distribution. Soil gas samples were placed in a shipping box (without ice), and shipped via Federal Express® to Air Toxics, Inc., in Folsom, CA for TVH and BTEX analysis. The results of the soils and soil gas samples are presented in Table 2.2.

2.2.2 Exceptions to Test Protocol Document Procedures

No exceptions to the Test Protocol Document procedures were conducted during the initial pilot test at FT-28.

2.2.3 Field QA/QC Results

Field quality assurance/quality control (QA/QC) samples included collection and analysis of duplicate samples for the media sampled. Consistent with requirements of the protocol the number of QA/QC samples was ten percent of the total number of samples collected for each medium. The results of the QA/QC samples are included in Appendices A, B and C.

3.0 PILOT TEST RESULTS

3.1 Hurlburt Field Fire Training Area (FT-39)

3.1.1 Initial Soil Gas Chemistry

Prior to initiating any air injection, soil gas in the VW and all MPs were sampled for TVH, oxygen, and carbon dioxide. The VW and MPs were purged to remove stale soil gas prior to monitoring. Soil gas monitoring was accomplished using portable gas analyzers as described in the Protocol Document. The results of the initial monitoring is presented in Table 3.1.

As shown in Table 3.1, the VW and all MPs, with the exception of MPs at two shallow locations (MPA-3.5-4.0 and MPB-3.5-4.0), had completely depleted oxygen levels (0.0%), high carbon dioxide readings (greater than 7%), and TVH readings ranging from 16,000 parts per million (ppm) to greater than 20,000 ppm. These readings suggest that the indigenous microorganisms have completely depleted the naturally available oxygen supply, indicating significant biological activity. In contrast, the background monitoring point (EAFB2-1) indicated a high concentration of oxygen (approximately 13% oxygen) in the soil gas and less than 6% carbon dioxide. These measurements represent the subsurface condition at a depth of about 6 to 8 feet bgs (screen interval estimated above the water table in well EAFB2-1). TVH reading was estimated at 220 ppm.

3.1.2 Air Permeability

An air permeability test was conducted according to the Protocol Document procedures on 18 March 1994. Air was injected into the VW for three hours at a rate of approximately 13 cubic feet per minute (cfm) and an average pressure of 40 inches of water. Steady-state pressure levels were achieved at all MPs in approximately 170 minutes. Table 3.2 provides the maximum steady-state pressures at each discrete monitoring point.

Due to the gradual response and relatively lengthy time to achieve steady-state conditions, the dynamic method of determining soil permeability was selected (Hinchee et al., 1992). Using the HyperVentilate® model, an air permeability value ranging from 14 to 150 darcys was calculated for this site. The air permeability, calculated using the steady-state method, was 6.8 darcys. The radius of pressure influence is estimated to exceed 60 feet for this site as presented in the models in Appendix D (note that pressure influence was observed at MPs located at 40 feet from the vent well at this site).

3.1.3 Oxygen Influence

The depth and radius of oxygen influence in the subsurface resulting from air injection into the central VW is the primary design parameter for bioventing systems. Optimization of full-scale and multiple VW systems requires pilot testing to determine the volume of soil that can be oxygenated at a given flow rate and vent well screen configuration.

Table 3.3 presents the change in soil gas oxygen levels that occurred after approximately three days of continuous air injection. This period of air injection, at approximately 7 cfm (average), produced an increase in soil gas oxygen concentrations at least 40 feet from the VW. Based on the oxygen increase and the pressure response at the furthest monitoring point (MPC), the long-term radius of oxygen influence will exceed 40 feet when air is injected at a rate of approximately 7 cfm.

3.1.4 In-Situ Respiration Rates

In-situ respiration tests were performed at the following monitoring points and depths: MPA (5.5 to 6 feet bgs), MPB (5.5 to 6 feet bgs), and MPC (3.0 to 3.5 feet bgs). These points were chosen based on their low oxygen readings (0.0%), high carbon dioxide readings (greater than 7%), and high TVH readings (greater than 20,000 ppm).

A 2-4 percent helium in air mixture was injected into each of the three discrete monitoring points for 17 hours during the initial part of the in-situ respiration test. Oxygen, carbon dioxide, and TVH concentrations were then measured in the soil gas at each discrete monitoring point. These readings were collected for approximately 72 hours following cessation of the helium/air injection period. The measured oxygen losses were then used to calculate biological oxygen utilization rates. The results of the in-situ respiration testing for the MPs are presented in Figures 3.1 through 3.3. Table 3.4 provides a summary of the oxygen utilization rates.

Because helium is a conservative, inert gas, the change in helium concentration over time can be useful in determining the effectiveness of the bentonite seals between each discrete monitoring point in the MPs. Figures 3.1 through 3.3 compare oxygen utilization and helium retention. Helium recovery was erratic and no conclusions regarding leakage or diffusion can be drawn from these data.

Oxygen loss was linear at every interval during the respiration test. Oxygen utilization rates observed at FT-39 were very consistent and ranged from 0.0026 to 0.0034% per minute (Table 3.4). Initial respiration test data is presented in Table 3.5.

At FT-39, an estimated 1,100 milligrams (mg) of fuel per kilogram of soil can be degraded each year. This value is the average of the fuel consumption rates calculated for every point at which a respiration test was conducted. The interval-specific fuel consumption rates were calculated using observed oxygen utilization rates, estimated air-filled porosities, and a conservative ratio of 3.5 mg of oxygen consumed for every 1 mg of fuel biodegraded. The air-filled porosity calculated for each sampling point ranged from 0.17 to 0.18 liters of air per kilogram of soil.

3.1.5 Potential Air Emissions

The long-term potential for air emissions from full-scale bioventing operations at FT-39 are considered to be low because of the age and type of the site contaminants (greater than five years, and primarily JP4 jet fuel). Additionally, health and safety monitoring conducted during the permeability test using a PID sensitive to 1 ppm barely exceeded background levels. Because the potential for air emissions is highest during the initial air injection period, and very little emissions were detected, the long-term emission potential is considered low. Finally, the site is very isolated at the Hurlburt field, and is several hundred feet from any permanently occupied building.

3.2 Eglin Main Old Fire Training Area (FT-28)

3.2.1 Initial Soil Gas Chemistry

Prior to initiating any air injection, soil gas in the VW and all MPs were sampled for TVH, oxygen, and carbon dioxide. The VW and MPs were purged to remove stale soil gas prior to monitoring. Soil gas monitoring was accomplished using portable gas analyzers as described in the Protocol Document. The results of the initial monitoring is presented in Table 3.6.

As shown in Table 3.6, the VW and all MPs had completely depleted oxygen levels (0.0%), high carbon dioxide readings (greater than 10%), and TVH readings exceeding

20,000 ppm. These readings suggest that the indigenous microorganisms have completely depleted the naturally available oxygen supply, indicating significant biological activity. In contrast, the background monitoring point (EAFB1-1) indicated near atmospheric conditions in the soil gas (i.e. greater than 20% oxygen and less than 0.5% carbon dioxide) to a depth of at least 35 feet bgs.

3.2.2 Air Permeability

An air permeability test was conducted according to the Protocol Document procedures on 23 March 1994. Air was injected into the VW for two and one-half hours at a rate of approximately 92 cubic feet per minute (cfm) and an average pressure of four inches of water. Steady-state pressure levels were achieved at all MPs in less than approximately 150 minutes. Table 3.7 provides the maximum steady-state pressures at each discrete monitoring point.

Due to the gradual response and relatively lengthy time to achieve steady-state conditions, the dynamic method of determining soil permeability was selected (Hinchee et al., 1992). Using the HyperVentilate® model, an air permeability value ranging from 77 to 305 darcys was calculated for this site. The air permeability, calculated using the steady-state method, was 70.4 darcys. The radius of pressure influence is estimated to exceed 60 feet for this site as presented in the models in Appendix D (note that pressure influence was observed at MPs located at 40 feet from the vent well at this site).

3.2.3 Oxygen Influence

The depth and radius of oxygen influence in the subsurface resulting from air injection into the central VW is the primary design parameter for bioventing systems. Optimization of full-scale and multiple VW systems requires pilot testing to determine the volume of soil that can be oxygenated at a given flow rate and vent well screen configuration.

Table 3.8 presents the change in soil gas oxygen levels that occurred after 17 hours of continuous air injection. This period of air injection, at approximately 92 cfm, produced an increase in soil gas oxygen concentrations at least 40 feet from the VW. Based on the oxygen increase and the pressure response at the furthest monitoring point (MPC), the long-term radius of oxygen influence will exceed 40 feet when air is injected at a rate of approximately 92 cfm.

3.2.4 In-Situ Respiration Rates

In-situ respiration tests were performed at the following monitoring points and depths: MPA (4.5 to 5 feet bgs), MPB (25.5 to 26 feet bgs), and MPC (38.5 to 39 feet bgs). These points were chosen based on their low oxygen readings (0.0%), high carbon dioxide readings (greater than 10%), and high TVH readings (greater than 20,000 ppm). A 2-4 percent helium in air mixture was injected into each of the three discrete monitoring points of MPA for 27 hours during the initial part of the in-situ respiration test. Oxygen, carbon dioxide, and TVH concentrations were then measured in the soil gas at each discrete monitoring point. These readings were collected for approximately 74 hours following cessation of the helium/air injection period. The measured oxygen losses were then used to calculate biological oxygen utilization rates. The results of the

in-situ respiration testing for the points are presented in Figures 3.4 through 3.6. Table 3.9 provides a summary of the oxygen utilization rates.

Because helium is a conservative, inert gas, the change in helium concentration over time can be useful in determining the effectiveness of the bentonite seals between each discrete monitoring point in the MPs. Figures 3.4 through 3.6 compare oxygen utilization and helium retention. Helium recovery was erratic and no conclusions regarding leakage or diffusion can be drawn from these data.

Oxygen loss was linear at every interval during the respiration test. Oxygen utilization rates observed at FT-28 were very consistent and ranged from 0.001 to 0.004% per min (Table 3.9). Initial respiration test data is presented in Table 3.10.

At FT-28, an estimated 860 mg of fuel per kilogram of soil can be degraded each year. This value is the average of the fuel consumption rates calculated for every point at which a respiration test was conducted. The interval-specific fuel consumption rates were calculated using observed oxygen utilization rates, estimated air-filled porosities, and a conservative ratio of 3.5 mg of oxygen consumed for every 1 mg of fuel biodegraded. The air-filled porosity calculated for each sampling point ranged from 0.09 to 0.17 liters of air per kilogram of soil.

3.2.5 Potential Air Emissions

The long-term potential for air emissions from full-scale bioventing operations at FT-28 are considered to be low because of the age and type of the site contaminants (greater than ten years, and primarily JP4 jet fuel). The site history and contaminants at FT-39 are very similar to FT-28. Health and safety monitoring conducted during the permeability test using a PID sensitive to 1 ppm did not detect any hydrocarbons above background levels in the breathing zone or at the ground surface. Because the potential for air emissions is highest during the initial air injection period, and no emissions were detected, the long-term emission potential is considered low. The site is very isolated on Eglin AFB, and is several thousand feet from any permanently occupied building.

4.0 RECOMMENDATIONS

Initial bioventing test at FT-39 and FT-28 indicate that naturally occurring oxygen has been depleted in the contaminated soils, and that air injection will be an effective method of increasing aerobic fuel biodegradation. AFCEE has recommended that air injection begin at both sites to determine the long-term radius of oxygen influence and the effects of time, available nutrients and changing temperatures on fuel biodegradation rates.

A one horsepower regenerative blower has been installed at FT-39 and at FT-28 to inject air at a rate of up to 8 cfm at FT-39 and 88 cfm at FT-28. This size blower was installed to allow for expansion of the bioventing system to include multiple air injection vent wells to impact an even larger area if necessary in the future. Extended (one-year) testing began at Hurlburt Field Site FT-39 on March 20, 1994. Due to a delay in power installation the extended test at Eglin Site FT-28 did not begin until July 6, 1994. ES will return to the base at six months and one year to analyze the soil gas and conduct

follow-up in-situ respiration tests. Additionally, at the one year point, ES will collect soil samples from both sites to determine the soil contamination levels after one year of in-situ treatment.

Based on the results of the first year of pilot-scale bioventing, AFCEE will recommend one of three options for these sites:

1. Upgrade, if necessary, and continue operation of the bioventing systems.
2. If the one year soil samples indicate that significant contamination removal has occurred, AFCEE may recommend additional soil sampling to confirm that the cleanup criteria has been achieved.
3. If significant difficulties or poor results are encountered during the bioventing pilot test, AFCEE may recommend removal of the blower system and proper abandonment of the VW and MPs.

5.0 REFERENCES

Engineering-Science, Inc. 1993. *Draft Bioventing Test Work Plan for A-20 Radar (SS-01) Hurlburt Field Fire Training Area (Site FT-39), Eglin Main Old Fire Training Area (FT-28)*. December.

Hinchee, R.E., Ong, S.K., Miller, R.N., Downey, D.C., Frandt, R. 1992. *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing*. Columbus, Ohio. January.

Figure 1.1

**SITE LAYOUT MAP
HURLBURT FIELD FTA - (FT-39)
EGLIN AFB, FLORIDA**

GDE268-3/CD/DSS/1093

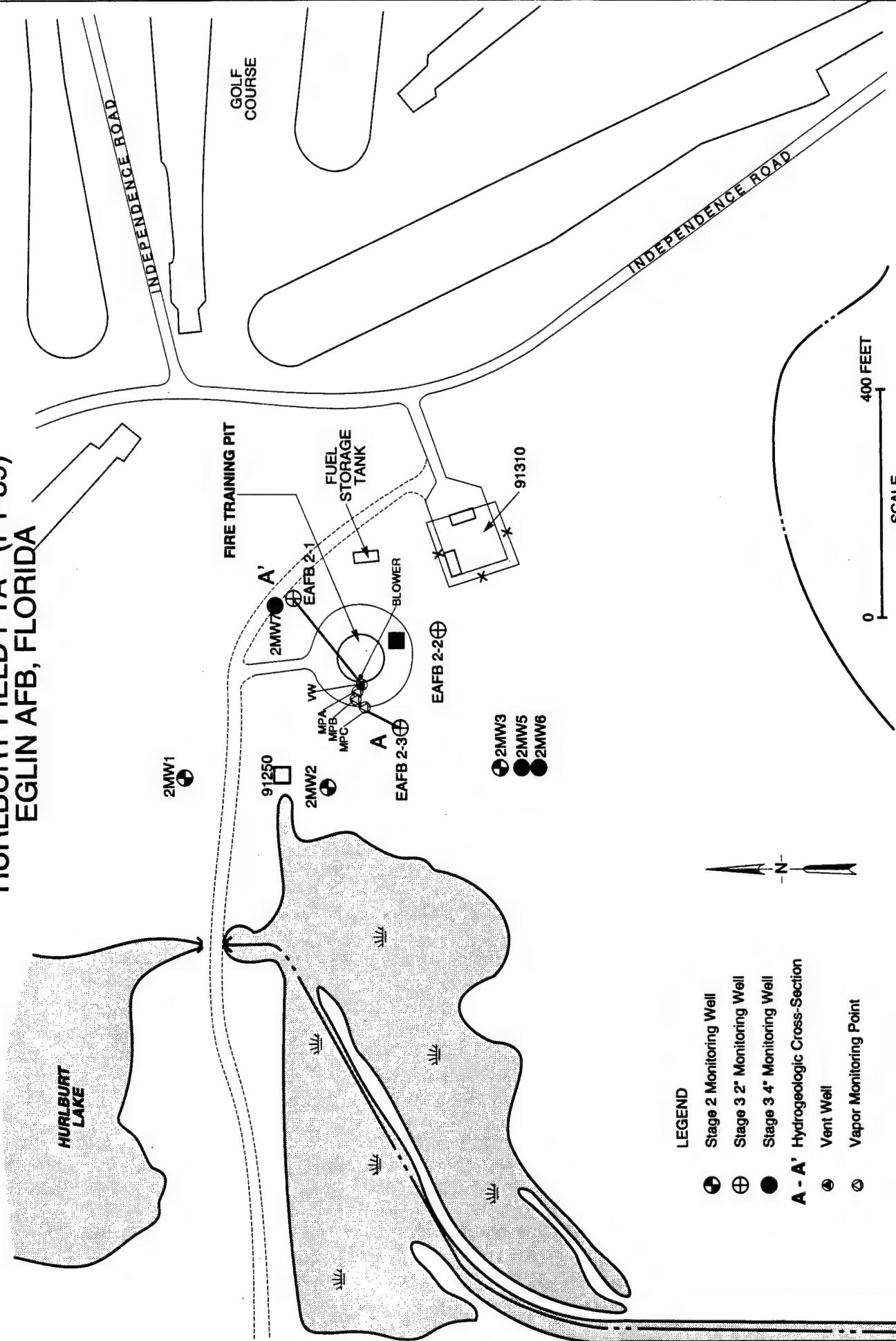
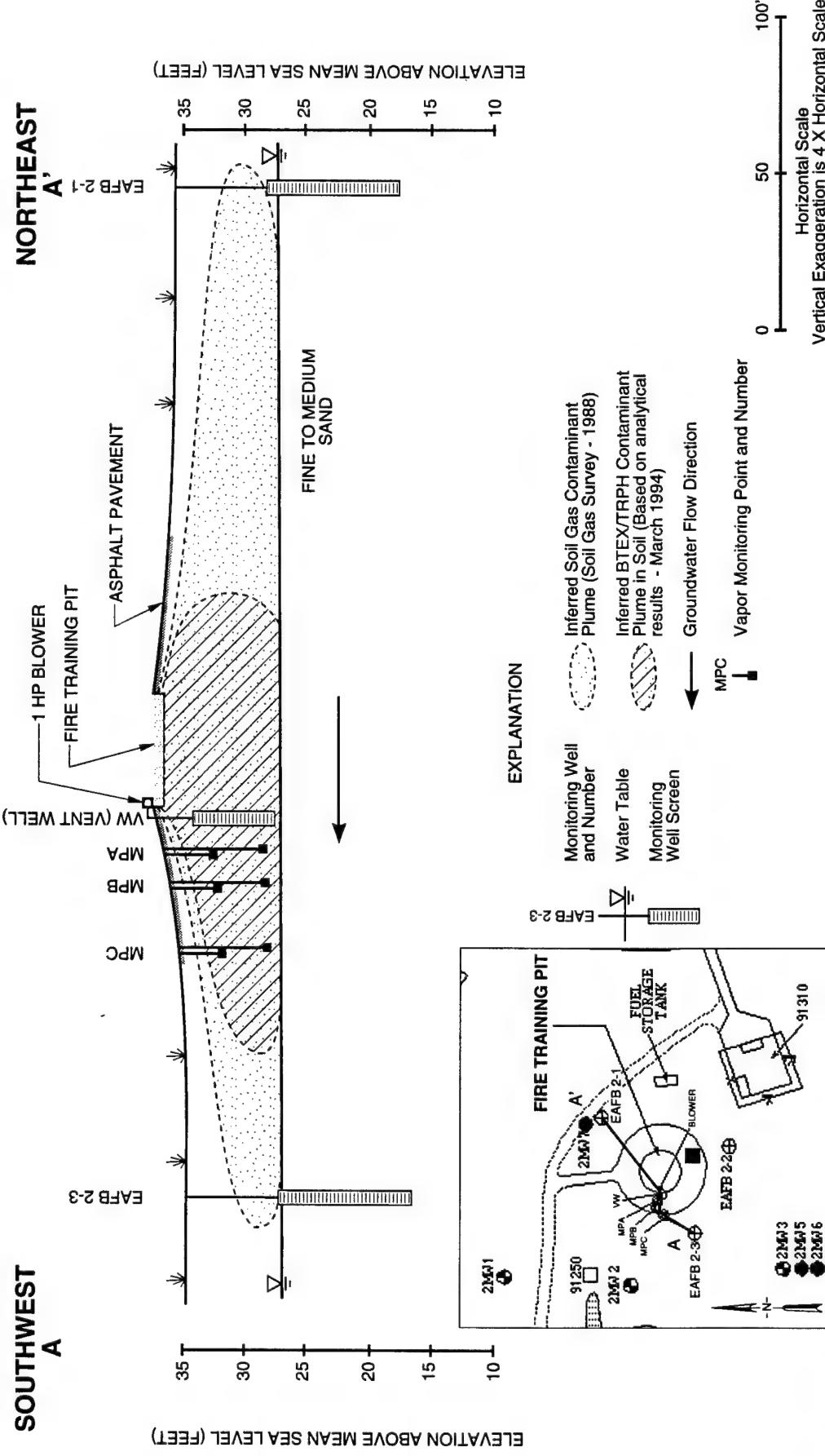
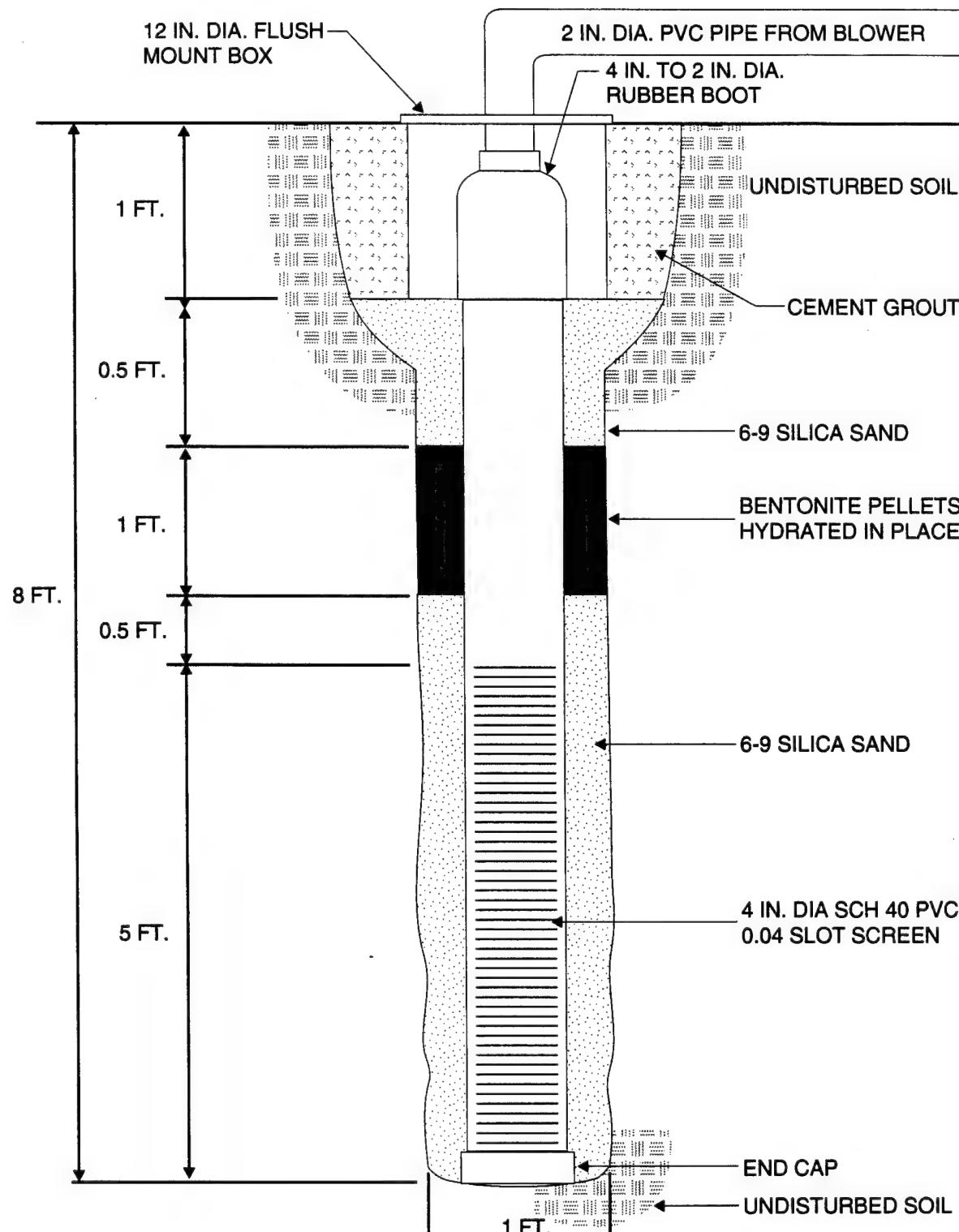


Figure 1.2

HYDROGEOLOGIC CROSS-SECTION A - A'
HURLBURT FIELD FIRE TRAINING AREA (FT-39)
EGLIN AFB, FLORIDA



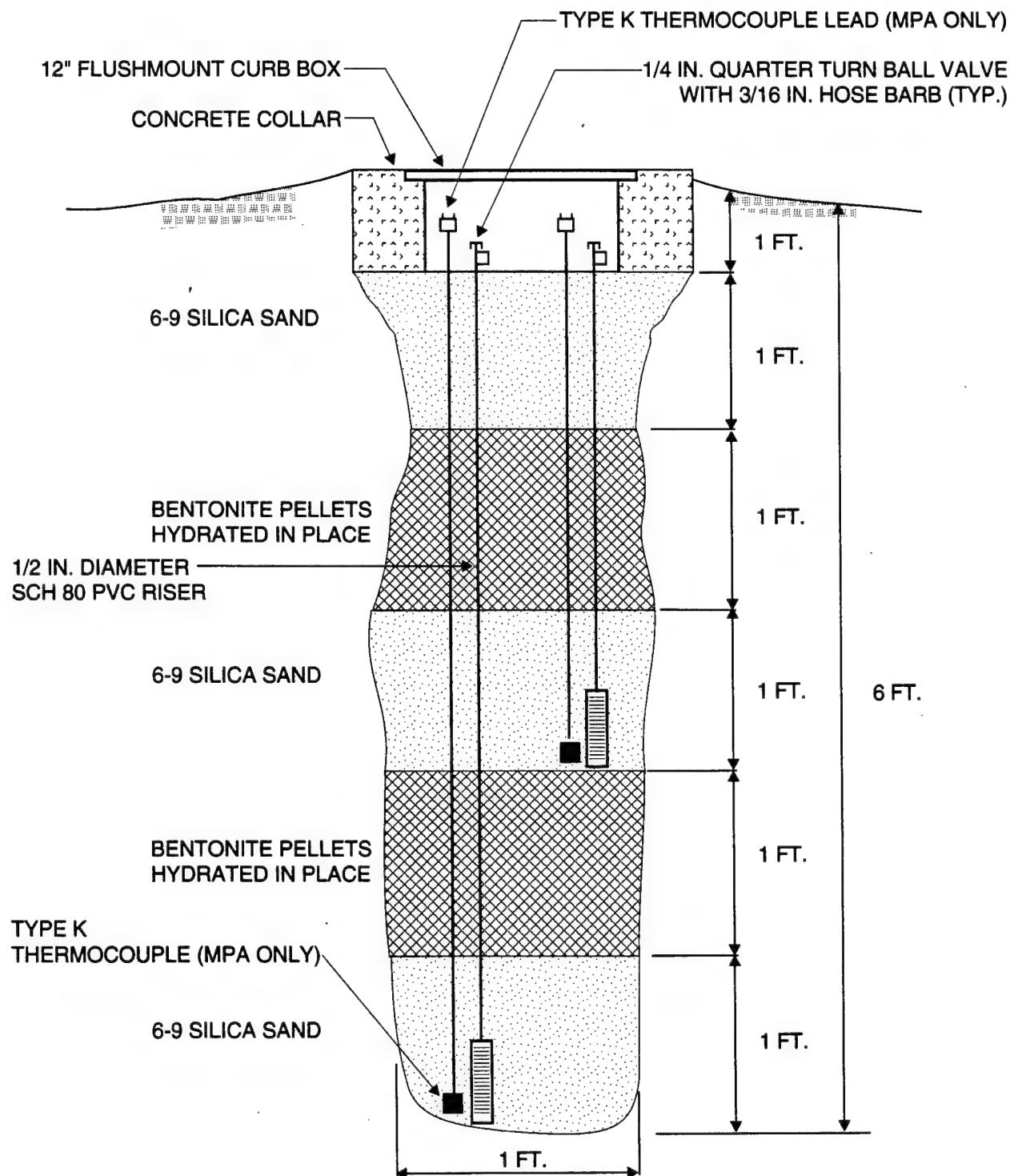
INJECTION VENT WELL CONSTRUCTION DETAIL
HURLBURT FIELD FTA - (FT - 39)
EGLIN AFB, FLORIDA



NOT TO SCALE

Figure 1.4

**TYPICAL MONITORING POINT
HURLBURT FIELD FTA - (FT-39)
EGLIN AFB, FLORIDA**



**SCHEMATIC OF BLOWER SYSTEM
FOR AIR INJECTION
EGLIN AFB, FLORIDA**

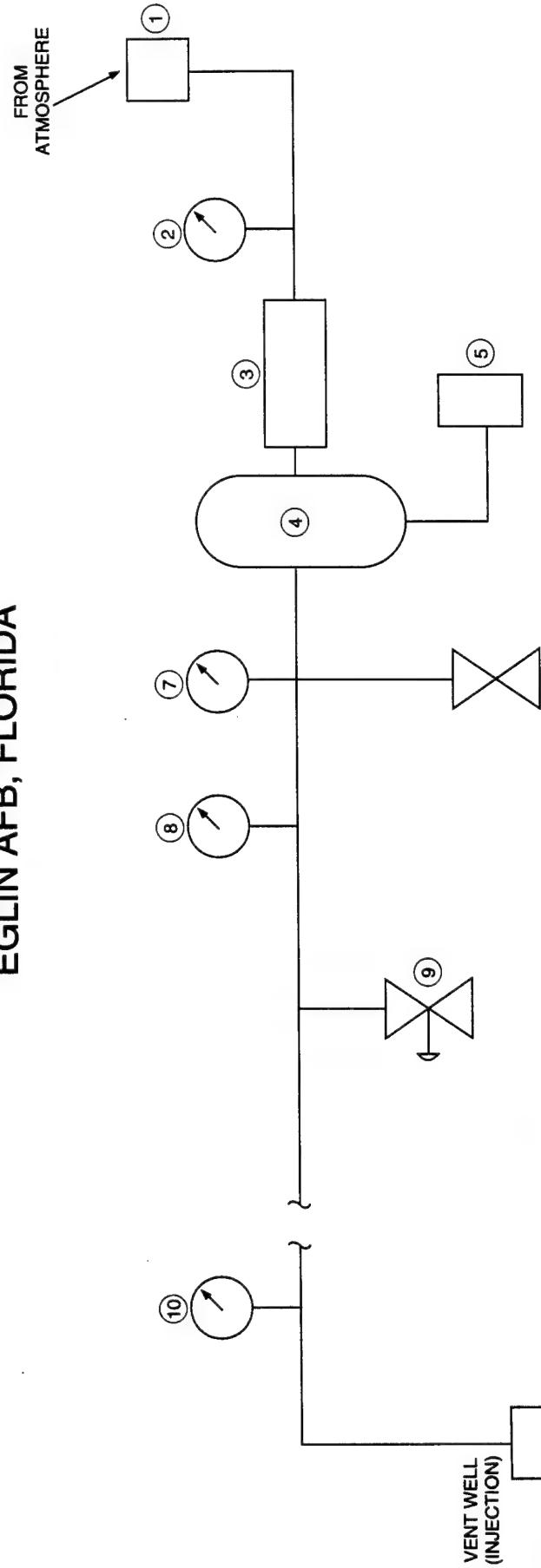
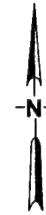
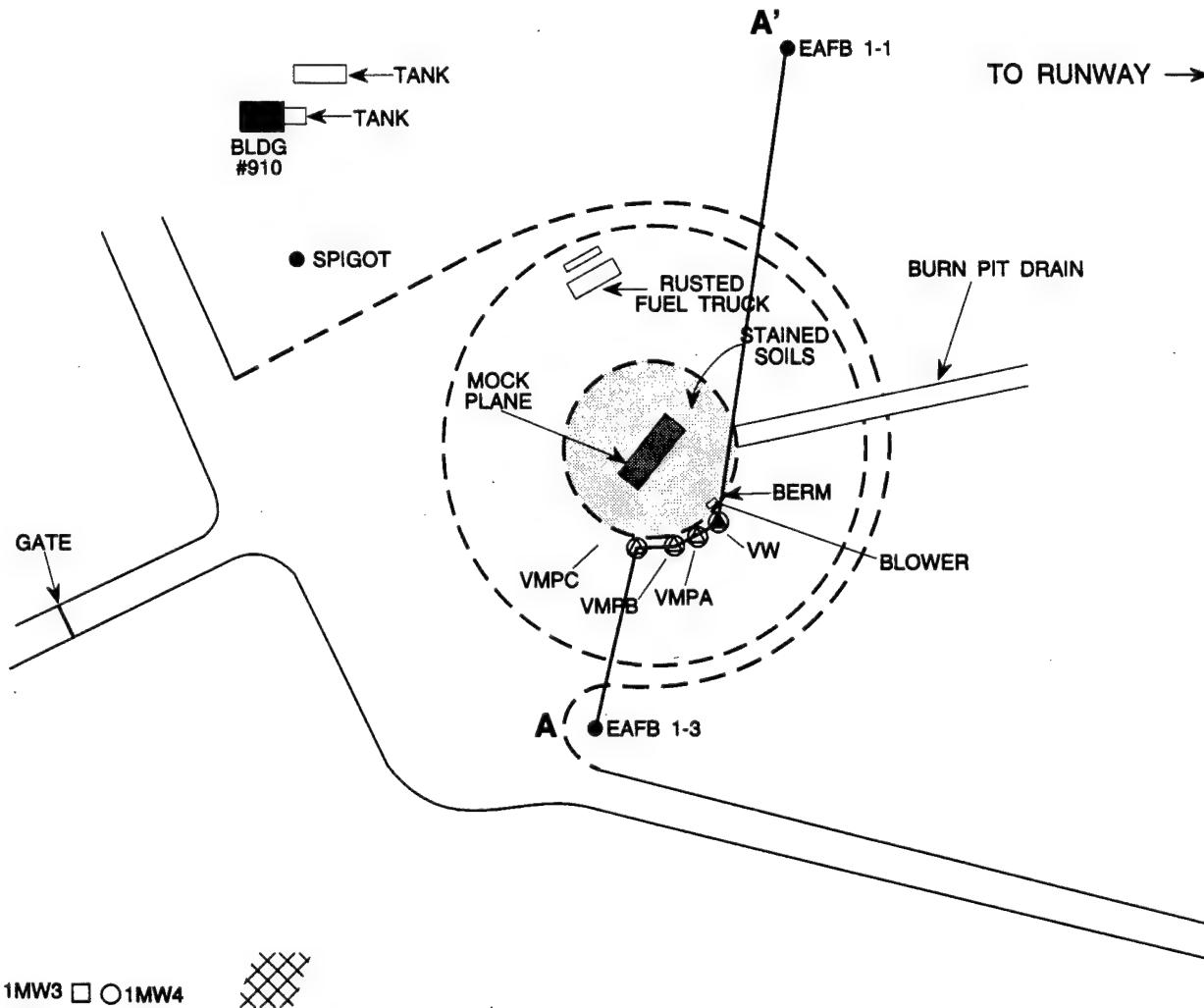


Figure 1.6

VENT WELL AND VAPOR MONITORING POINTS EGLIN MAIN BASE OLD FTA - (FT-28) EGLIN AFB



1MW2 1MW1



LEGEND

- VENT WELL
- VAPOR MONITORING POINT
- PATCHES OF ASPHALT, GLASS AND DEBRIS
- BOUNDARY OF FTA
- A - A'** HYDROGEOLOGIC CROSS-SECTION
- STAGE 3 2' MONITORING WELL
- STAGE 3 4' MONITORING WELL

EARTHEN BERM

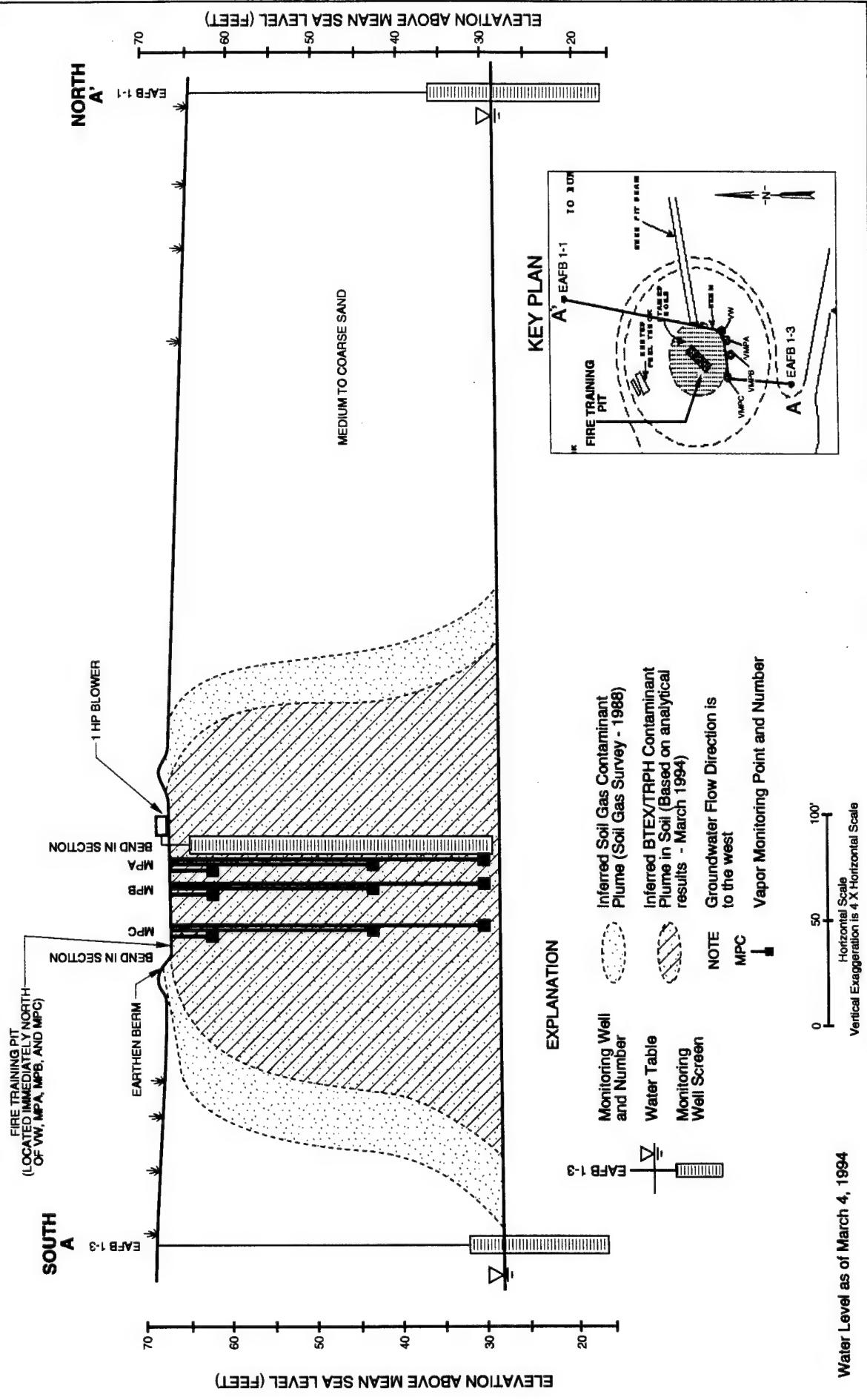


LOCATION OF
OLD FUEL STORAGE TANK
(REMOVED)

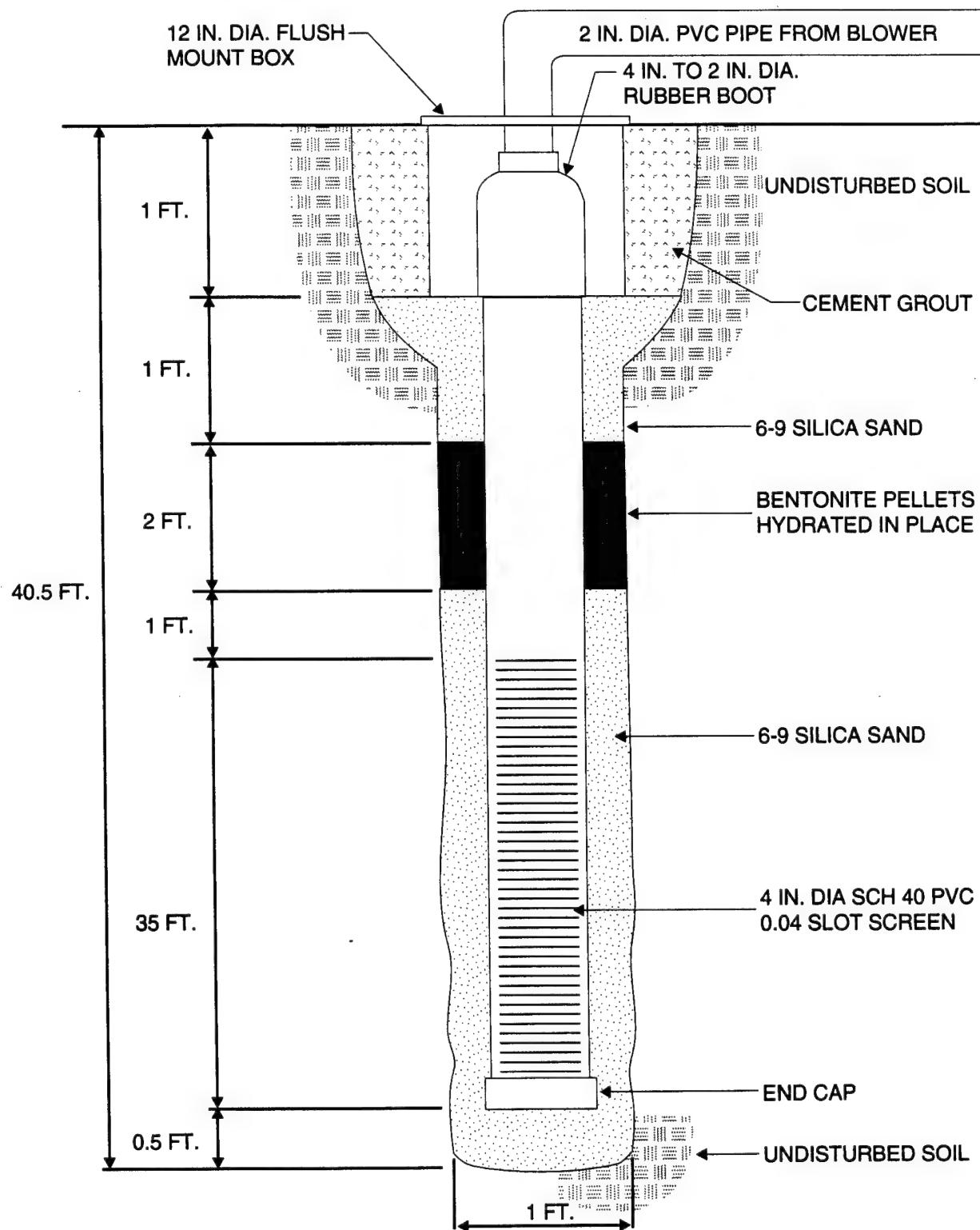
0 200 FEET
APPROXIMATE SCALE

Figure 1.7

**HYDROGEOLOGIC CROSS-SECTION A - A'
EGLIN MAIN OLD FIRE TRAINING AREA (FT-28)
EGLIN AFB, FLORIDA**



**INJECTION VENT WELL CONSTRUCTION DETAIL
EGLIN MAIN BASE OLD FTA - (FT - 28)
EGLIN AFB, FLORIDA**



NOT TO SCALE

**TYPICAL MONITORING POINT
EGLIN MAIN BASE OLD FTA - (SITE FT-28)
EGLIN AFB, FLORIDA**

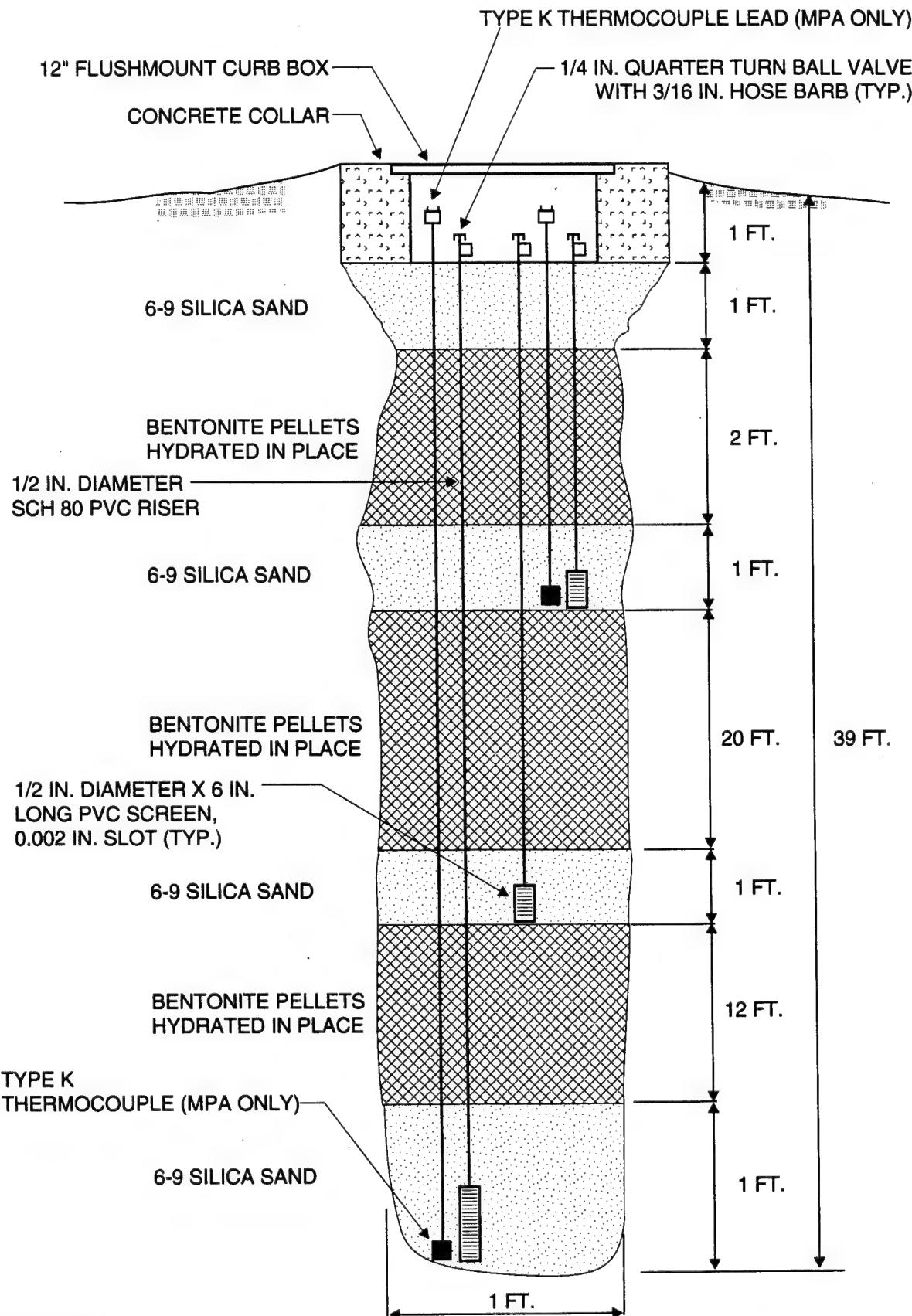


Figure 3.1

Initial Respiration Test
Oxygen and Helium Concentrations
Hurlburt FTA, MPA-Deep
Eglin AFB, Florida

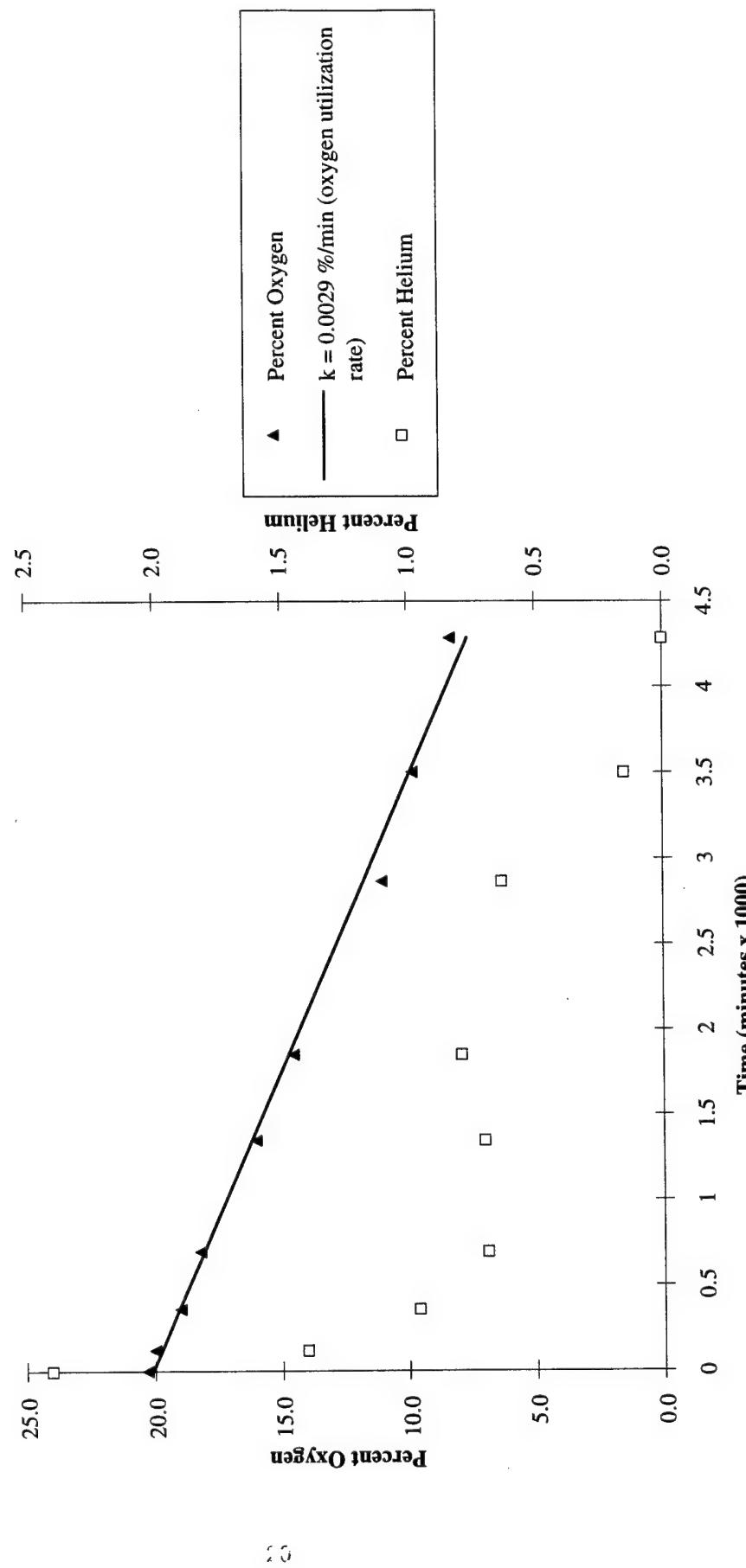


Figure 3.2

Initial Respiration Test
Oxygen and Helium Concentrations
Hurlburt FTA, MPB-Deep
Eglin AFB, Florida

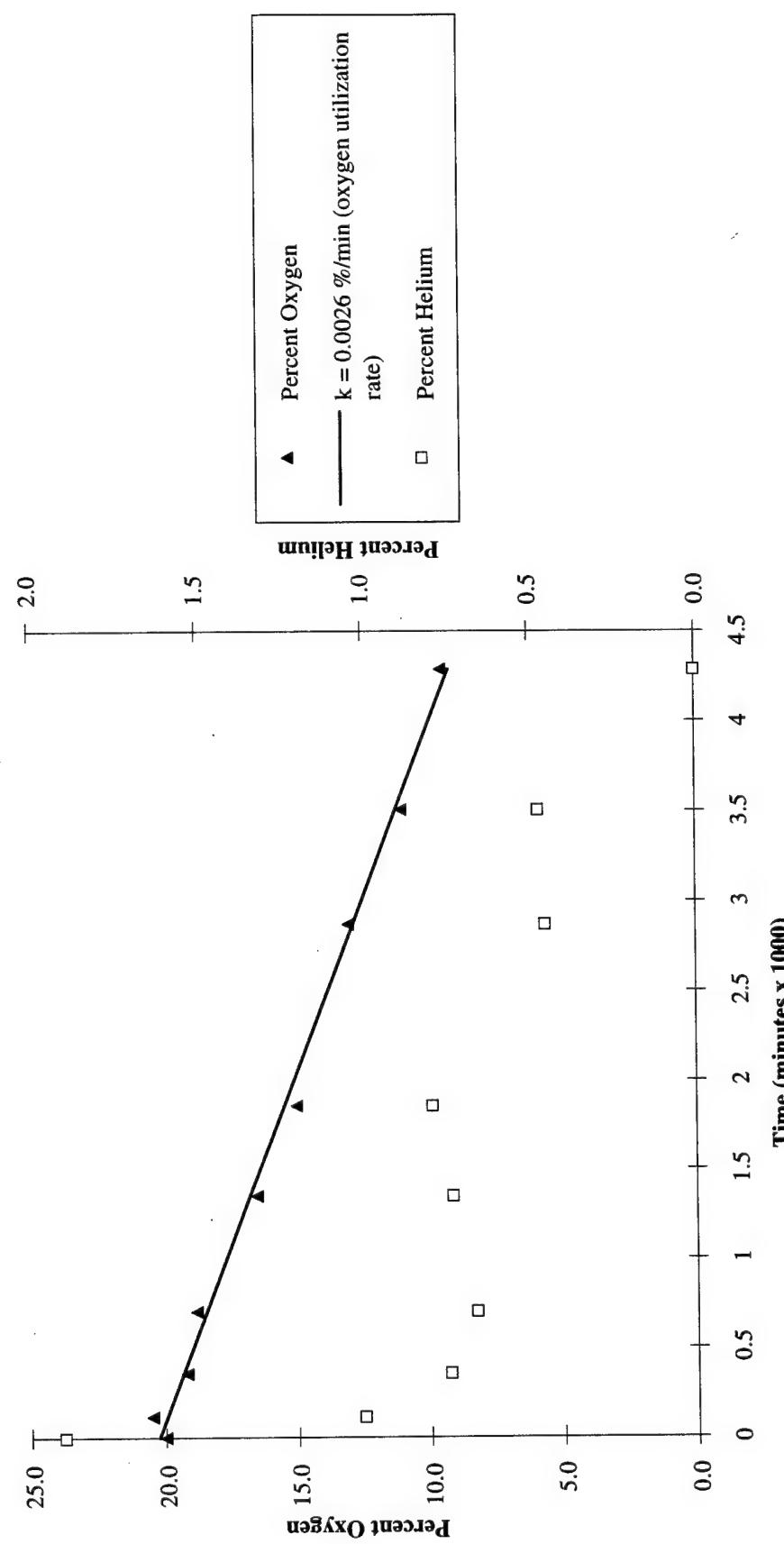


Figure 3.3

Initial Respiration Test
Oxygen and Helium Concentrations
Hurlburt FTA, MPC-Shallow
Eglin AFB, Florida

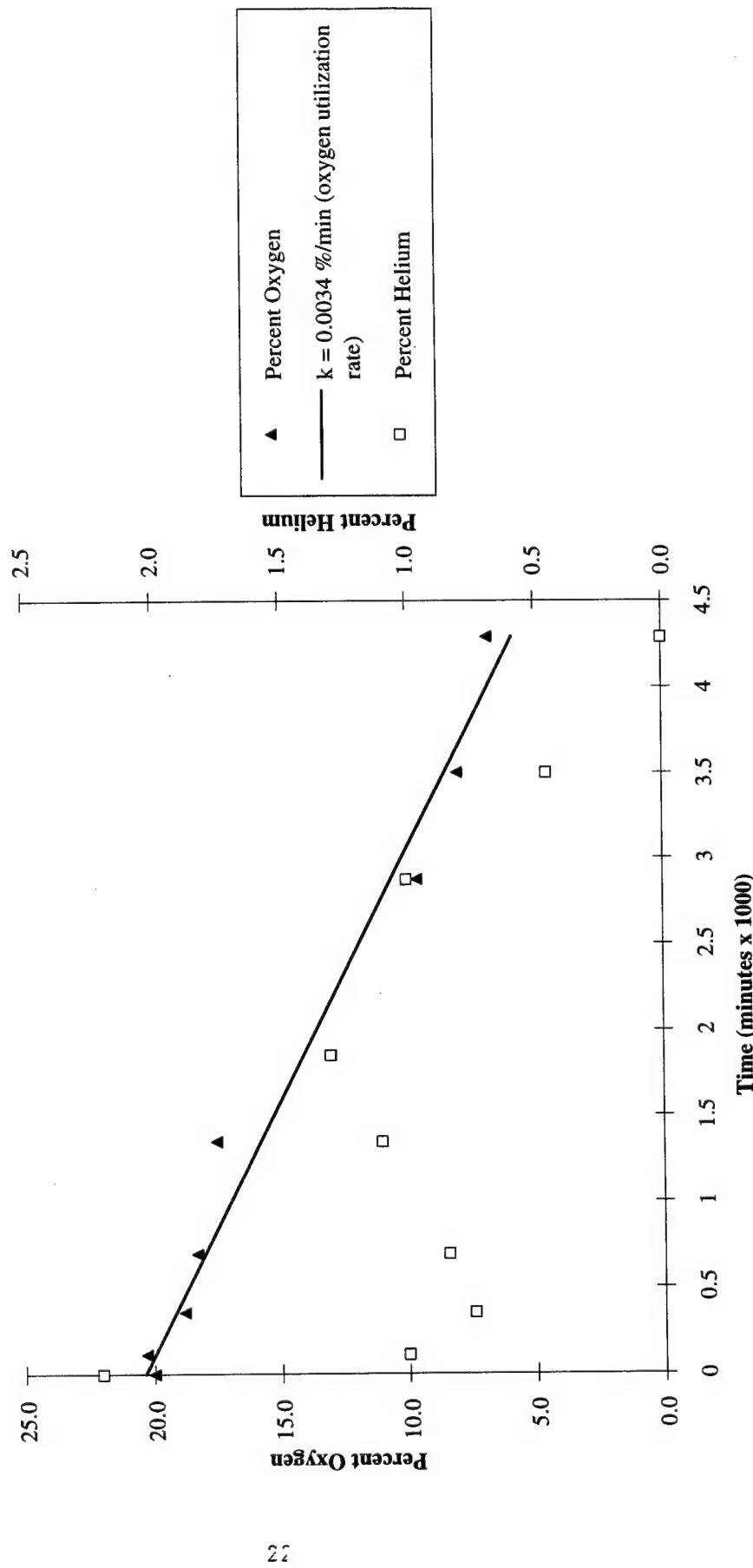


Figure 3.4

Initial Respiration Test
Oxygen and Helium Concentrations
Eglin FTA (EG2), MPA-Shallow
Eglin AFB, Florida

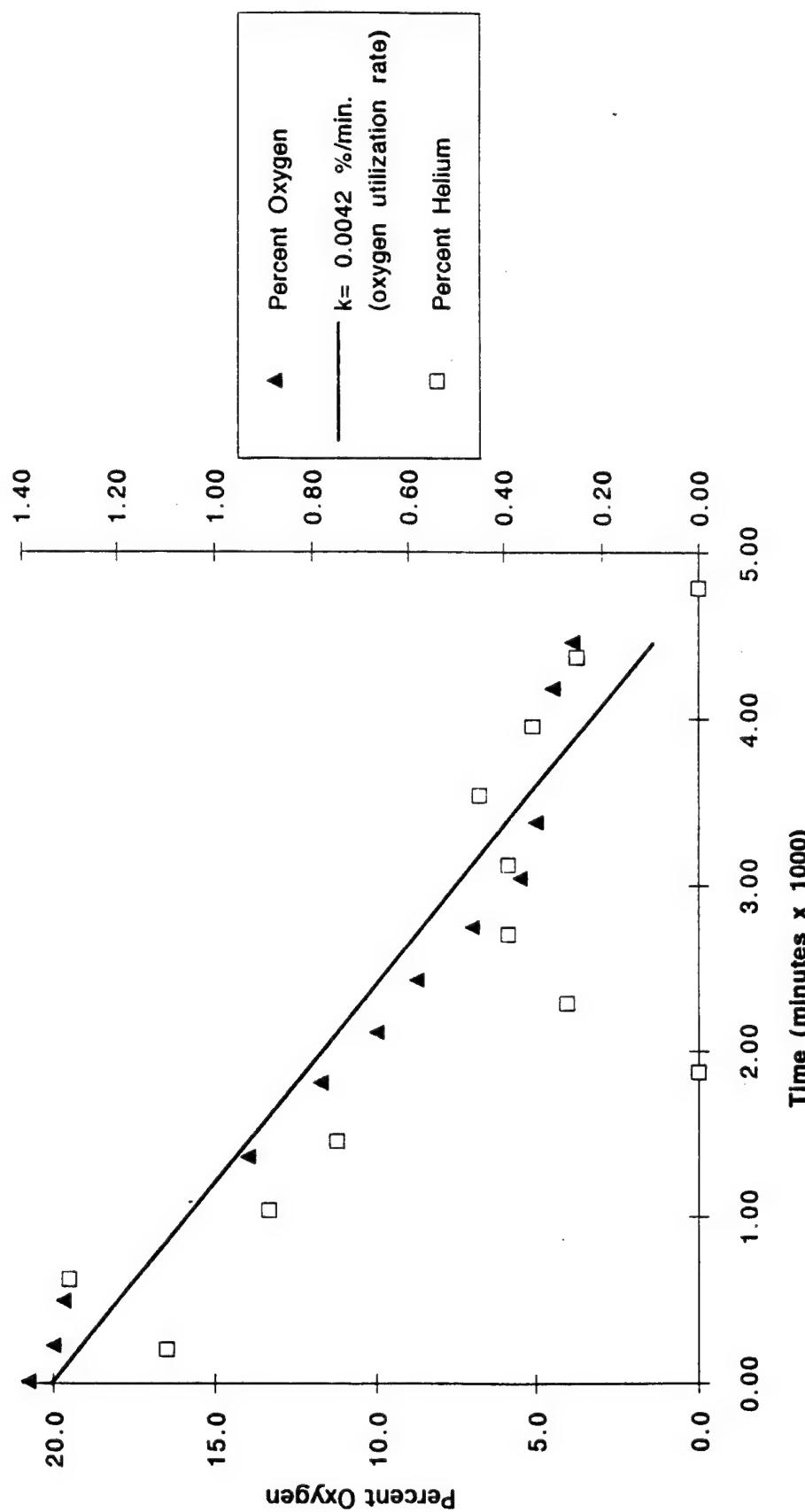


Figure 3.5

Initial Respiration Test
Oxygen and Helium Concentrations
Eglin FTA (EG2), MPB-Medium
Eglin AFB, Florida

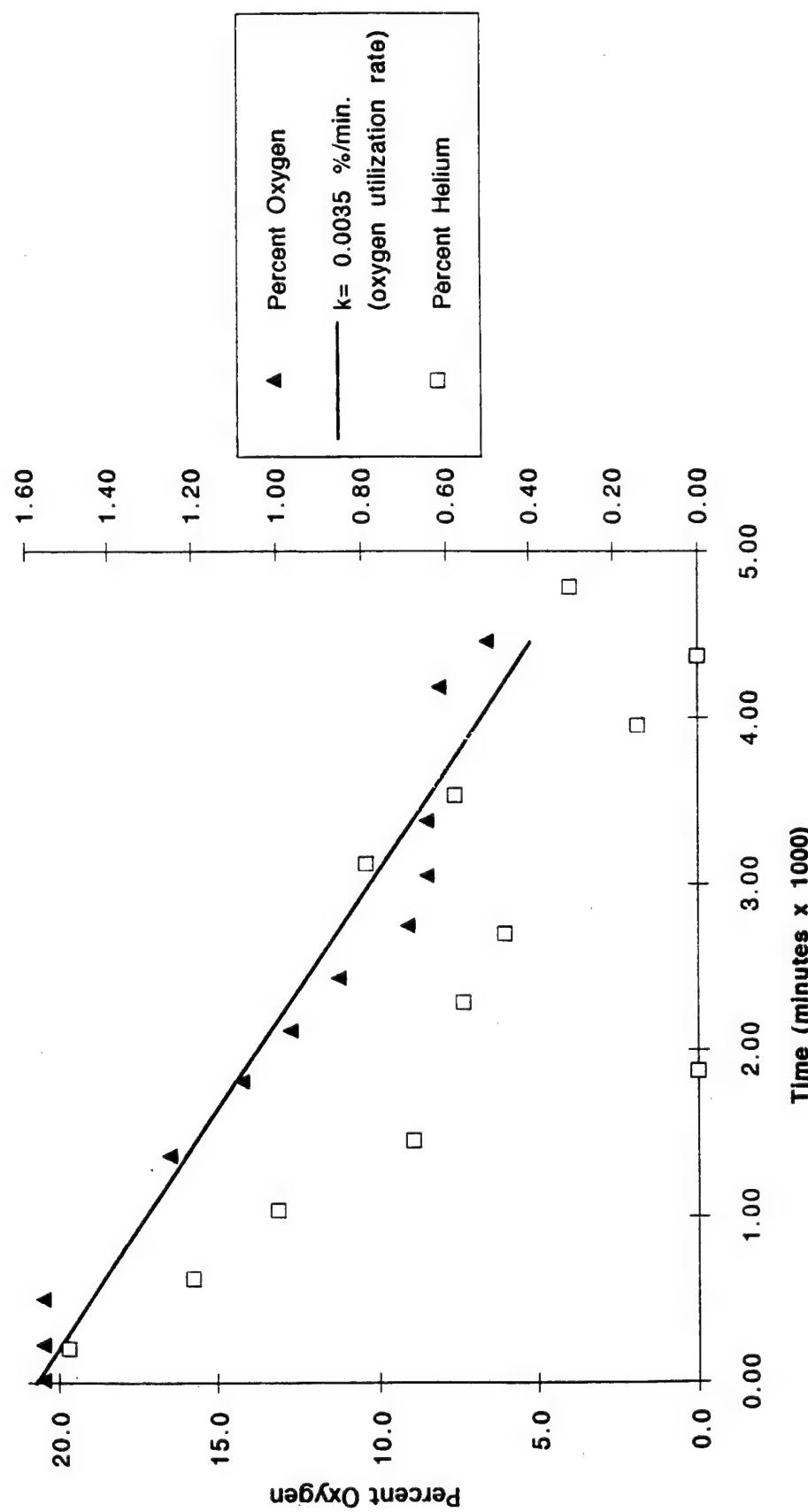


Figure 3.6

Initial Respiration Test
Oxygen and Helium Concentrations
Eglin FTA (EG2), MPC-Deep
Eglin AFB, Florida

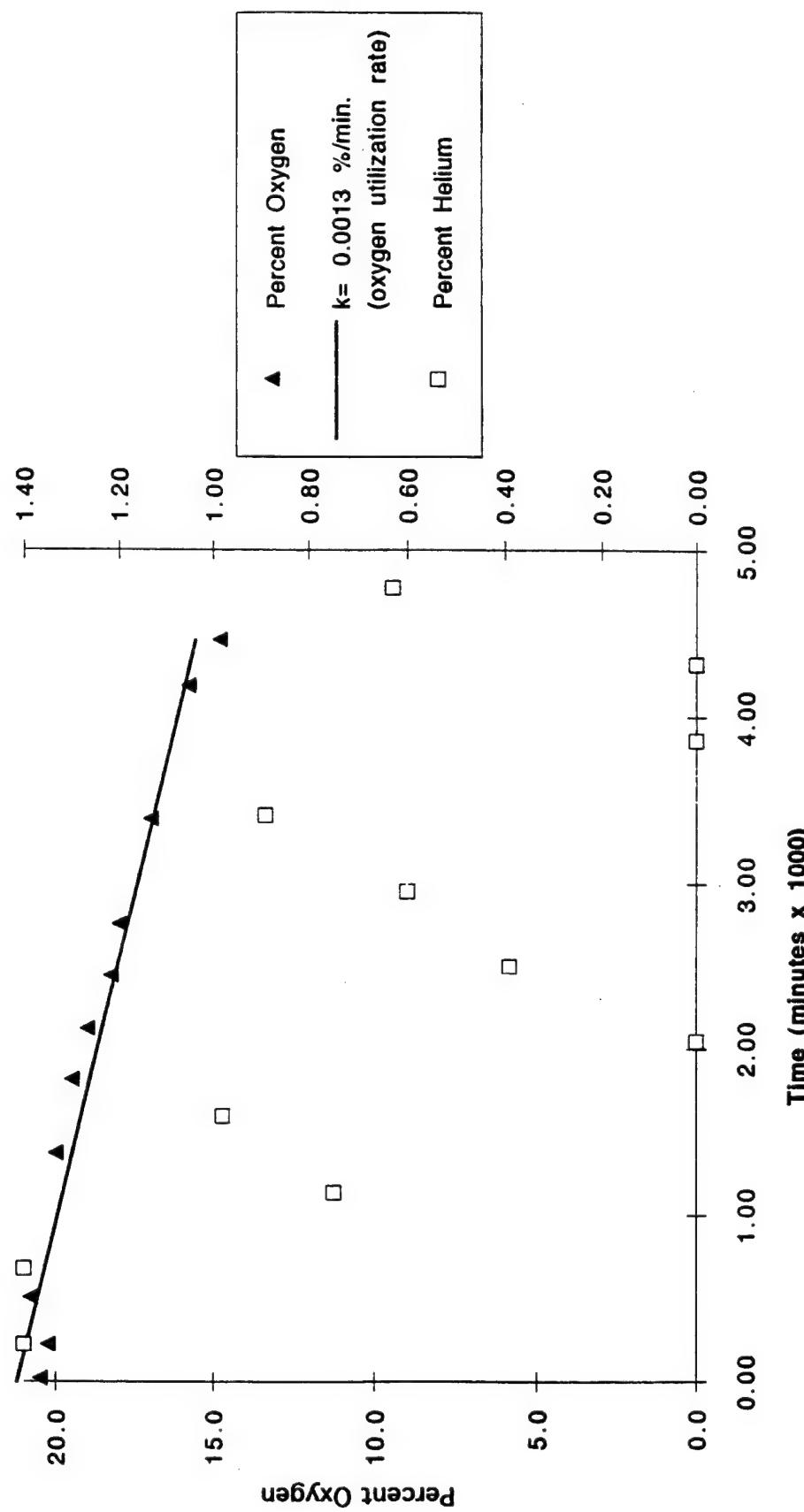


TABLE 2.1
SOIL AND SOIL GAS LABORATORY ANALYTICAL RESULTS
Fire Training Pit 1 - Hurlburt Field Fire Training Area (FT-39)
Eglin AFB, Florida

Analyte (Units)a	Sample Location - Depth (feet below ground surface)		
	<u>EG3-VW</u>	<u>EG3-MPA-3.5-4'</u>	<u>EG3-MPC-3.0-3.5'</u>
<u>Soil Gas Hydrocarbons</u>			
TPH (ppmv)	14000	13000	26000
Benzene (ppmv)	32	24	53
Toluene (ppmv)	20	19	100
Ethylbenzene (ppmv)	8.5	6.8	21
Xylenes (ppmv)	35	30	170
<u>Soil Hydrocarbons</u>	<u>EG3-VW-6-8'</u>	<u>EG3-MPA-3-5'</u>	<u>EG3-MPB-5'</u>
TRPH (mg/kg)	15,800	12,100	848
Benzene (mg/kg)	ND(0.54)	ND(2.6)	ND(2.7)
Toluene (mg/kg)	15	22	5.1
Ethylbenzene (mg/kg)	3.3	14	4.5
Xylenes (mg/kg)	26	88	29
<u>Soil Inorganics</u>			
Iron (mg/kg)	240	620	1,160
Alkalinity (mg/kg as CaCO ₃)	331	253	321
pH (units)	8.1	8.3	8.2
TKN (mg/kg)	ND (40)	120	83
Phosphates (mg/kg)	35	18	46
<u>Soil Physical Parameters</u>			
Moisture (% wt.)	6.9	5.8	7.1
Gravel (%)	0	0	0
Sand (%)	95.5	88.3	90
Silt (%)	1.9	6.5	4.8
Clay (%)	2.6	5.2	5.2
<u>Soil Temperature</u>	<u>EG3-MPA-3.5-4'</u>	<u>EG3-MPA-5.5-6'</u>	
	63°F	63.4°F	

a - TRPH = total recoverable petroleum hydrocarbons; TPH = total petroleum hydrocarbons;

mg/kg - milligrams per kilogram; ppmv = parts per million by volume; CaCO₃ = carbonate; TKN = total kjeldhal nitrogen.

ND - Not detected.

NS - Not sampled.

TABLE 2.2
SOIL AND SOIL GAS LABORATORY ANALYTICAL RESULTS
Eglin Main Old Fire Training Area (FT-28)
Eglin AFB, Florida

Analyte (Units)a	Sample Location - Depth (feet below ground surface)		
	EG2-VW	EG2-MPA-4.5-5'	EG2-MPC-38.5-39'
<u>Soil Gas Hydrocarbons</u>			
TPH (ppmv)	11,000	11,000	26,000
Benzene (ppmv)	94	93	250
Toluene (ppmv)	52	24	460
Ethylbenzene (ppmv)	20	20	47
Xylenes (ppmv)	76	64	220
<u>Soil Hydrocarbons</u>	EG2-VW-3-5'	EG2-MPA-37-39'	EG2-MPB-2-4'
TRPH (mg/kg)	2,210	3,370	6,610
Benzene (mg/kg)	10	0.15	ND (2.7)
Toluene (mg/kg)	21	0.19	ND (2.7)
Ethylbenzene (mg/kg)	24	0.4	9.9
Xylenes (mg/kg)	72	2.5	22
<u>Soil Inorganics</u>			
Iron (mg/kg)	2,560	135	2,100
Alkalinity (mg/kg as CaCO ₃)	354	ND (42)	128
pH (units)	8.2	6.6	7.8
TKN (mg/kg dry weight)	ND (43)	ND (43)	ND (43)
Phosphorus (mg/kg dry weight)	28	29	15
<u>Soil Physical Parameters</u>			
Moisture (% wt.)	6	7	7.6
Gravel (%)	0.1	0	0
Sand (%)	91.8	92.5	92.2
Silt (%)	2.1	4.0	1.8
Clay (%)	6	3.5	6.1
<u>Soil Temperature</u>	EG2-MPA-4.5-5'	EG2-MPA-38.5-39'	
	58.7°F	70.3°F	

a - TRPH = total recoverable petroleum hydrocarbons; TPH = total petroleum hydrocarbons;

mg/kg - milligrams per kilogram; ppmv = parts per million by volume; CaCO₃ =

carbonate; TKN = total kjeldhal nitrogen.

ND - Not detected- Detection limit in parenthesis.

NS - Not sampled.

TABLE 3.1
INITIAL SOIL GAS CHEMISTRY
Hurlburt Fire Training Area (FT-39)
Eglin AFB, Florida

MP Depth (ft)	O2 (%)	CO2 (%)	TVH (ppm)
EG3-VW-3-8	0.0	9	20,000+
EG3-MPA-3.5-4.0	1.2	7	20,000+
EG3-MPA-5.5-6.0	0.0	8.5	20,000+
EG3-MPB-3.5-4.0	3.5	5.25	16,000
EG3-MPB-5.5-6.0	0.0	7.5	20,000+
EG3-MPC-3.0-3.5	0.0	9	20,000+
EG3-MPC-5.0-5.5	0.0	9	20,000+

TABLE 3.2
MAXIMUM PRESSURE RESPONSE
AIR PERMEABILITY TEST
Hurlburt Fire Training Area (FT-39)
Eglin AFB, Florida

	Distance from injection well (EG3-VW)					
	10' (MPA)	20' (MPB)	40' (MPC)			
Depth (feet)	3.5-4.0	5.5-6.0	3.5-4.0	5.5-6.0	3.0-3.5	5.0-5.5
Time (minutes)	170	170	170	170	170	170
Max Pressure (inches H2O)	11.6	12.2	5.98	7.45	3.09	3.2

TABLE 3.3
INFLUENCE OF AIR INJECTION AT VENT WELL
ON MONITORING POINT OXYGEN LEVELS
Hurlburt Fire Training Area (FT-39)
Eglin AFB, Florida

MP	Distance from VW (ft)	Screen Depth (ft)	Initial O2 (%)	Final O2 (%) End of Permeability Test	O2 After 3 Days of Injection
EG3-MPA-Shallow	10	3.5-4.0	1.2	19.0	20.0
EG3-MPA-Deep	10	5.5-6.0	0	20.4	20.0
EG3-MPB-Shallow	20	3.5-4.0	3.5	20.0	20.5
EG3-MPB-Deep	20	5.5-6.0	0	20.0	20.9
EG3-MPC-Shallow	40	3.0-3.5	0	0.0	19.4
EG3-MPC-Deep	40	5.0-5.5	0	0.0	20.0

TABLE 3.4
SUMMARY OF OXYGEN UTILIZATION RATES
Hurlburt Fire Training Area (FT-39)
Eglin AFB, Florida

Monitoring Point	Oxygen Utilization Rate (%/minute)
EG3-MPA-5.5-6.0	0.0029
EG3-MPB-5.5-6.0	0.0026
EG3-MPC-3.0-3.5	0.0034

TABLE 3.5
Initial Respiration Test
Hurlburt FTA
Eglin AFB, Florida

Monitoring Point	Date	Days Elapsed	Hrs elapsed (frac. days)	Elapsed Time (min. x 1000)	Days Elapsed (fractional days)	Elapsed Time (min. x 1000)	CO2%	Total Hydro-carbon	Helium	Comments	Trend of O2	New x-value*	k
											Time	x-value*	
MPA-Deep	03/15/94	0.00	10.00	0.00	0.00	0.00	20.3	0.20	1.10	2.40	20.101453	0	0.002922
MPB-Deep	03/15/94	0.00	12.00	0.08	0.08	0.12	20.0	0.30	2.90	1.40	7.5656199	4.29	
MPA-Deep	03/15/94	0.00	16.00	0.25	0.25	0.36	19.0	0.50	5.00	0.96	Temperature = 62.8 degrees F.		
MPA-Deep	03/15/94	0.00	21.40	0.49	0.49	0.70	18.2	0.50	7.80	0.69			
MPA-Deep	03/16/94	1.00	08.30	-0.06	0.94	1.35	16.0	0.60	1.000	0.70	Temperature = 63.4 degrees F.		
MPA-Deep	03/16/94	1.00	16.55	0.29	1.29	1.86	14.5	0.80	1.100	0.79			
MPA-Deep	03/17/94	2.00	08.50	-0.01	1.99	2.87	11.0	1.25	1.100	0.63			
MPA-Deep	03/17/94	2.00	20.25	0.43	2.43	3.51	9.6	1.50	1.200	0.15			
MPA-Deep	03/18/94	3.00	09.25	-0.02	2.98	4.29	8.3	1.60	1.400	0.00			
MPB-Deep	03/15/94	0.00	10.02	0.00	0.00	0.00	20.0	0.20	3.2	1.90	20.252725	0	0.002577
MPB-Deep	03/15/94	0.00	11.57	0.08	0.08	0.12	20.5	0.20	4.8	1.00	9.1980212	4.29	
MPB-Deep	03/15/94	0.00	16.00	0.25	0.25	0.36	19.2	0.50	1.60	0.74			
MPB-Deep	03/15/94	0.00	21.46	0.49	0.49	0.71	18.8	0.60	2.80	0.66			
MPB-Deep	03/16/94	1.00	08.32	-0.05	0.94	1.35	16.5	0.70	5.40	0.73			
MPB-Deep	03/16/94	1.00	16.58	0.29	1.29	1.86	15.0	0.80	6.40	0.79			
MPB-Deep	03/17/94	2.00	09.55	0.10	2.00	2.88	13.0	1.00	7.00	0.45			
MPB-Deep	03/17/94	2.00	20.28	0.44	2.44	3.51	11.0	1.50	9.40	0.47			
MPB-Deep	03/18/94	3.00	08.30	-0.02	2.98	4.29	9.5	1.50	1.000	0.00			
MPC-Shallow	03/15/94	0.00	10.05	0.01	0.01	0.00	20.0	0.20	8.4	2.20	20.359211	0	0.003387
MPC-Shallow	03/15/94	0.00	11.55	0.31	0.08	0.12	20.3	0.40	2.20	1.00	5.7940976	4.3	
MPC-Shallow	03/15/94	0.00	16.00	0.25	0.25	0.36	18.8	0.50	2.80	0.74			
MPC-Shallow	03/15/94	0.00	21.40	0.40	0.49	0.70	18.3	0.50	6.40	0.84			
MPC-Shallow	03/16/94	1.00	08.34	-0.05	0.94	1.35	17.5	0.60	1.000	1.10			
MPC-Shallow	03/16/94	1.00	17.00	0.29	1.29	1.86	13.0	1.00	1.200	1.30			
MPC-Shallow	03/17/94	2.00	10.00	0.00	2.00	2.88	9.6	1.90	2.000	1.00			
MPC-Shallow	03/17/94	2.00	20.30	0.44	2.44	3.51	8.0	2.10	3.200	0.45			
MPC-Shallow	03/18/94	3.00	09.37	-0.02	2.98	4.30	6.8	2.50	3.600	0.00			

TABLE 3.6
INITIAL SOIL GAS CHEMISTRY
Eglin Main Old Fire Training Area (FT-28)
Eglin AFB, Florida

MP Depth (ft)	O2 (%)	CO2 (%)	TVH (ppm)
EG2-VW-5-40	0.0	10.5	20,000+
EG2-MPA-4.5-5	0.0	10.25	20,000+
EG2-MPA-25.5-26	0.0	10.25	20,000+
EG2-MPA-38.5-39	NM	NM	NM
EG2-MPB-4-4.5	0.0	10.25	20,000+
EG2-MPB-25.5-26	0.0	10.25	20,000+
EG2-MPB-38-38.5	0.0	10.5	20,000+
EG2-MPC-4-4.5	0.0	10.75	20,000+
EG2-MPC-25.5-26	0.0	10.5	20,000+
EG2-MPC-38-38.5	0.0	11	20,000+

NM-Not Measured (unable to draw sample)

TABLE 3.7
MAXIMUM PRESSURE RESPONSE
AIR PERMEABILITY TEST
Eglin Main Old Fire Training Area (FT-28)
Eglin AFB, Florida

	Distance from injection well (EG2-VW)								
	10' (MPA)			20' (MPB)			40' (MPC)		
Depth (feet)	4.5	25.5	38.5	4.5	25.5	38.5	4.5	25.5	38.5
Time (minutes)	150	150	-	125	125	-	150	150	150
Max Pressure (inches H2O)	2.15	2.6	-	1.8	1.77	-	1.4	1.5	1.5

Note: water table may have risen above the screen at the deep monitoring points at MPA and MPB.

Readings could not be obtained at these points as shown in Table 3.7.

TABLE 3.8
INFLUENCE OF AIR INJECTION AT VENT WELL
ON MONITORING POINT OXYGEN LEVELS
Eglin Main Old Fire Training Area (FT-28)
Eglin AFB, Florida

MP	Distance from VW (ft)	Screen Depth (ft)	Initial O2 (%)	Final O2 (%) End of Permeability Test	O2 After 17 Hours of Injection
EG2-MPA-Shallow	10	4.5-5.0	0	19.75	19.5
EG2-MPA-Mid depth	10	25.5-26.0	0	20.5	20.8
EG2-MPA-Deep	10	38.5-39	NM	NM	NM
EG2-MPB-Shallow	20	4.5-5.0	0	11.25	17.0
EG2-MPB-Mid depth	20	25.5-26.0	0	5.5	20.8
EG2-MPB-Deep	20	38.5-39	0	NM	NM
EG2-MPC-Shallow	40	4.5-5.0	0	0	0
EG2-MPC-Mid depth	40	25.5-26.0	0	0	0
EG2-MPC-Deep	40	38.5-39	0	11	19.5

NM- Not Measured (unable to draw sample-suspected a clogged screen or screen in water table)

TABLE 3.9
SUMMARY OF OXYGEN UTILIZATION RATES
Eglin Main Old Fire Training Area (FT-28)
Eglin AFB, Florida

Monitoring Point	Oxygen Utilization Rate (%/minute)
EG2-MPA-4.5-5.0'	0.0042
EG2-MPB-25.5-26'	0.0035
<u>EG2-MPC-38.5-39'</u>	<u>0.0013</u>

TABLE 3.10
Initial Respiration Test
Eglin FTA (EG2),
Eglin AFB, Florida

Monitoring Point	Date	Days Elapsed (frac. days)	Hrs elapsed (fractional days)	Elapsed Time	Days Elapsed (min. x 1000)	CO2%	Total Hydro-carbon	Helium	Comments		Trend of O2 Time	New x-values	k
									0.01	0.01			
MPA-Shallow	03/18/94	0.00	11.25	0.01	0.01	0.16	0.23	20.0	0.60	NS	1.30		
MPA-Shallow	03/18/94	0.00	15.00	0.01	0.01	0.35	0.50	19.7	0.70	NS	0.89		
MPA-Shallow	03/18/94	0.00	19.33	0.01	0.01	0.94	1.36	14.0	0.90	3.200	0.75		
MPA-Shallow	03/19/94	1.00	09.53	-0.06	0.06	1.25	1.81	11.8	1.70	5.800	NS		
MPA-Shallow	03/19/94	1.00	17.20	0.26	0.26	1.47	2.11	10.0	2.00	7.200	0.27		
MPA-Shallow	03/19/94	1.00	22.25	0.47	0.47	1.69	2.43	8.8	2.60	9.000	0.39		
MPA-Shallow	03/20/94	2.00	03.40	-0.31	-0.31	1.91	2.75	7.0	2.00	>10.000	0.39		
MPA-Shallow	03/20/94	2.00	09.00	-0.08	-0.08	2.11	3.04	5.5	2.30	>10.000	0.45		
MPA-Shallow	03/20/94	2.00	13.57	0.11	0.11	2.35	3.38	5.0	3.80	>10.000	0.34		
MPA-Shallow	03/20/94	2.00	19.33	0.35	0.35	2.91	4.18	4.5	4.80	>10.000	0.25		
MPA-Shallow	03/21/94	3.00	08.57	-0.09	-0.09	3.10	4.46	3.9	5.00	>10.000	NS		
MPA-Shallow	03/21/94	3.00	13.34	0.10	0.10	4.46	5.00	5.00	5.00	>10.000	NS		
MPB-Medium	03/18/94	0.00	11.30	0.01	0.01	0.16	0.23	20.5	0.50	NS	1.50		
MPB-Medium	03/18/94	0.00	15.01	0.01	0.01	0.35	0.50	20.5	0.60	NS	1.20		
MPB-Medium	03/18/94	0.00	19.36	0.01	0.01	0.95	1.37	16.5	0.80	4.800	0.68		
MPB-Medium	03/19/94	1.00	09.58	-0.05	-0.05	1.26	1.81	14.3	1.30	7.500	NS		
MPB-Medium	03/19/94	1.00	17.22	0.26	0.26	1.47	2.12	12.8	1.90	9.200	0.56		
MPB-Medium	03/19/94	1.00	22.30	0.47	0.47	1.69	2.44	11.3	2.50	10.000	0.46		
MPB-Medium	03/20/94	2.00	03.50	-0.31	-0.31	1.91	2.75	9.1	3.00	>10.000	0.79		
MPB-Medium	03/20/94	2.00	09.04	-0.08	-0.08	2.12	3.05	8.5	3.50	>10.000	0.58		
MPB-Medium	03/20/94	2.00	14.02	0.12	0.12	2.35	3.38	8.5	3.80	>10.000	0.14		
MPB-Medium	03/20/94	2.00	19.36	0.35	0.35	2.91	4.19	8.1	4.90	>10.000	NS		
MPB-Medium	03/21/94	3.00	08.59	-0.09	-0.09	3.10	4.46	6.6	5.10	>10.000	0.30		
MPC-Deep	03/18/94	0.00	11.34	0.01	0.01	0.16	0.23	20.3	0.50	NS	1.40		
MPC-Deep	03/18/94	0.00	15.02	0.01	0.01	0.35	0.51	20.8	0.60	NS	1.40		
MPC-Deep	03/18/94	0.00	19.40	0.01	0.01	0.95	1.37	20.0	0.60	0.75	Helium meter needs charged		
MPC-Deep	03/19/94	1.00	10.02	-0.05	-0.05	1.26	1.81	19.5	0.60	1.200	0.98		
MPC-Deep	03/19/94	1.00	17.24	0.26	0.26	1.47	2.12	19.0	0.60	2.200	NS		
MPC-Deep	03/19/94	1.00	22.32	0.47	0.47	1.69	2.44	18.3	0.60	3.000	0.39		
MPC-Deep	03/20/94	2.00	03.53	-0.31	-0.31	1.91	2.75	16.0	0.70	4.300	0.60		
MPC-Deep	03/20/94	2.00	09.07	-0.09	-0.09	2.12	3.39	17.0	0.70	NS	0.89	Got 0.77 on check for repeatability.	
MPC-Deep	03/20/94	2.00	19.38	0.35	0.35	2.91	4.19	15.8	0.80	8.400	NS		
MPC-Deep	03/21/94	3.00	09.00	-0.09	-0.09	3.10	4.46	14.8	0.90	>10.000	0.63		

APPENDIX A

ANALYTICAL DATA FOR AIR SAMPLES AT FT-39

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9403129

Work Order Summary

CLIENT: Ms. Diana Schenfeld
Engineering Science
1700 Broadway, Suite 900
Denver, CO 80290

BILL TO: Same

PHONE: 303-831-8100
FAX: 303-831-8208
DATE RECEIVED: 3/16/94
DATE COMPLETED: 3/24/94

INVOICE # 3240
P.O. # DE268.43.040
PROJECT # DE268.43.040 Eglin AFB
AMOUNT\$: \$462.87

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	PRICE
01A	EG3-VW	TO-3	1.5 "Hg	\$120.00
02A	EG3-MPA Shallow	TO-3	3.0 "Hg	\$120.00
02B	EG3-MPA Shallow Duplicate	TO-3	3.0 "Hg	NC
03A	EG3-MPC Shallow	TO-3	2.0 "Hg	\$120.00
04A	Method Spike	TO-3	NA	NC
05A	Lab Blank	TO-3	NA	NC
Misc. Charges	1 Liter SUMMA Canister Preparation (3) @ \$10.00 each. Shipping (2/28/94)			\$30.00 \$72.87

CERTIFIED BY: Diana J. Furman
Laboratory Director

DATE: 3/24/94

AIR TOXICS LTD.SAMPLE NAME: EG3-VW
ID#: 9403129-01A**EPA METHOD TO-3**
(Aromatic Volatile Organics in Air)**GC/PID**

File Name:	6031707			Date of Collection: 3/14/94
Dil. Factor:	270			Date of Analysis: 3/17/94
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.27	0.88	32	100
Toluene	0.27	1.0	20	77
Ethyl Benzene	0.27	1.2	8.5	38
Total Xylenes	0.27	1.2	35	150

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031707			Date of Collection: 3/14/94
Dil. Factor:	270			Date of Analysis: 3/17/94
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	2.7	18	14000	91000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: EG3-MPA Shallow
ID#: 9403129-02A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6031708			Date of Collection: 3/14/94
Dil. Factor:	220			Date of Analysis: 3/17/94
Compound		Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)
Benzene		0.22	0.71	24
Toluene		0.22	0.84	19
Ethyl Benzene		0.22	0.97	6.8
Total Xylenes		0.22	0.97	30
				130

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031708			Date of Collection: 3/14/94
Dil. Factor:	220			Date of Analysis: 3/17/94
Compound		Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)
TPH*		2.2	14	13000
				84000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: EG3-MPA Shallow Duplicate
ID#: 9403129-02B

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6031709			Date of Collection: 3/14/94
Dil. Factor:	220			Date of Analysis: 3/17/94
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.22	0.71	23	75
Toluene	0.22	0.84	18	69
Ethyl Benzene	0.22	0.97	6.7	30
Total Xylenes	0.22	0.97	29	130

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031709			Date of Collection: 3/14/94
Dil. Factor:	220			Date of Analysis: 3/17/94
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	2.2	14	12000	78000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: EG3-MPC Shallow
ID#: 9403129-03A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6031710			Date of Collection: 3/14/94
Dil. Factor:	270			Date of Analysis: 3/17/94
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.27	0.88	53	170
Toluene	0.27	1.0	100	380
Ethyl Benzene	0.27	1.2	21	93
Total Xylenes	0.27	1.2	170	750

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031710			Date of Collection: 3/14/94
Dil. Factor:	270			Date of Analysis: 3/17/94
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	2.7	18	26000	170000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Method Spike
ID#: 9403129-04A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6031701	Date of Collection: NA	
Dil. Factor:	1.0	Date of Analysis: 3/17/94	
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	% Recovery
Benzene	0.001	0.003	108
Toluene	0.001	0.004	106
Ethyl Benzene	0.001	0.004	103
Total Xylenes	0.001	0.004	104

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031703	Date of Collection: NA	
Dil. Factor:	1.0	Date of Analysis: 3/17/94	
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	% Recovery
TPH*	0.010	0.065	109

*TPH referenced to Jet Fuel (MW=156)

Container Type: NA

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank
ID#: 9403129-05A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6031705			Date of Collection: NA
Dil. Factor:	1.0			Date of Analysis: 3/17/94
Compound		Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)
Benzene		0.001	0.003	Not Detected
Toluene		0.001	0.004	Not Detected
Ethyl Benzene		0.001	0.004	Not Detected
Total Xylenes		0.001	0.004	Not Detected

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031705			Date of Collection: NA
Dil. Factor:	1.0			Date of Analysis: 3/17/94
Compound		Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)
TPH*		0.010	0.065	Not Detected

*TPH referenced to Jet Fuel (MW=156)

Container Type: NA

9403129

FIGURE B.3

CHAIN OF CUSTODY RECORD

ENGINEERING-SCIENCE, INC.		AFCEE BROWNING FLOW TESTS		Ship To:	
10 BROADWAY, SUITE 800 DENVER, COLORADO 80203 D-431-4100	Base: Eglin AFB, Ft. Walton Florida			Air Toxics Ltd. 180 Blue Ravine Rd. Suite B Folsom California 95630	
S Job No. E268.43.0000	Name: HU RUBERT FTA CEG3			Attn: Alexis Morydith	
Signature:					
Signature:					
Date	Time	Sample Description	Lab ID.	No. of Contam.	Remarks
1/14/94	1536	EG3 - V14		1	01A
1/14/94	1543	EG3 - MPC STATION		1	02A/B
1/14/94	1550	EG3 - MPC STATION		1	03A
RETEST & TIME					
10/26/94					
Remarks: Originally seals were present Samples sent out before being sent to Ora Andosika, Steve Ratcliff, Ed Glassa					
Date / Time	Received by Laboratory by: (Signature)		Date / Time		Engineering-Science, Inc.
3/14/94 9:45			3/14/94 9:45		1700 Broadway, Suite 800 • Denver, Colorado
Date / Time	Received by Laboratory by: (Signature)		Date / Time		Federal Express Number: 10031831-9100
3/14/94 1700			3/14/94 1700		73736523
Remarks: Original Acetate tape sample sent to Comstar Field Office					

**AIR TOXICS LTD.**

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9403252

Work Order Summary

CLIENT: Ms. Diana Schenfeld
 Engineering Science
 1700 Broadway, Suite 900
 Denver, CO 80290

BILL TO: Same

PHONE: 303-831-8100
FAX: 303-831-8208
DATE RECEIVED: 3/30/94
DATE COMPLETED: 4/5/94

INVOICE # 3335
P.O. # 722409.43040
PROJECT # 722409.43040 Eglin AFB
AMOUNT\$: \$140.00

FRACTION #	NAME	TEST	RECEIPT	VAC./PRES.	PRICE
01A	EG3-EAFB2-1	ASTM D-1945	1.5 "Hg	NA	\$140.00
02A	Lab Blank	ASTM D-1945	NA	NC	

CERTIFIED BY: *Diana J. Fuerma*
 Laboratory Director

DATE: *4/5/94*

AIR TOXICS LTD.SAMPLE NAME: EG3-EAFB2-1
ID#: 9403252-01A**NATURAL GAS ANALYSIS by ASTM D-1945**
GC/TCD/FID

File Name:	3033106	Date of Collection:	3/21/94
Dil. Factor:	2.1	Date of Analysis:	3/31/94

Compound	Det. Limit (%)	Amount (%)
Methane	0.002	Not Detected
Ethane	0.002	Not Detected
Propane	0.002	Not Detected
Isobutane	0.002	Not Detected
Butane	0.002	Not Detected
Neopentane	0.002	Not Detected
Isopentane	0.002	Not Detected
n-Pentane	0.002	Not Detected

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.SAMPLE NAME: Lab Blank
ID#: 9403252-02A**NATURAL GAS ANALYSIS by ASTM D-1945**
GC/TCD/FID

File Name:	3033105	Date of Collection:	NA
Dil. Factor:	1.0	Date of Analysis:	3/31/94

Compound	Det. Limit (%)	Amount (%)
Methane	0.001	Not Detected
Ethane	0.001	Not Detected
Propane	0.001	Not Detected
Isobutane	0.001	Not Detected
Butane	0.001	Not Detected
Neopentane	0.001	Not Detected
Isopentane	0.001	Not Detected
n-Pentane	0.001	Not Detected

Container Type: NA

ENGINEERING SCIENCE

CHAIN OF CUSTODY RECORD

~~94032152~~
~~9403252~~

b7c

Distribution Original Accompanies Shipment. Yellow Copy Returned With Report.

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9403205

Work Order Summary

copy to
 Diana Awosik
 ES - Atlanta

CLIENT: Ms. Diana Schenfeld
 Engineering Science
 1700 Broadway, Suite 900
 Denver, CO 80290

BILL TO: Same

PHONE: 303-831-8100**INVOICE #** 3286**FAX:** 303-831-8208**P.O. #** 722409.43040**DATE RECEIVED:** 3/24/94**PROJECT #** 722409.43040 Eglin AFB**DATE COMPLETED:** 3/30/94**AMOUNT\$:** \$130.00

<u>FRACTION #</u>	<u>NAME</u>	<u>TEST</u>	<u>RECEIPT</u>	<u>PRICE</u>
01A	EG3-EAFB2-1	TO-3	VAC./PRES. 1.5 "Hg	\$120.00
02A	Lab Blank	TO-3	NA	NC

Misc. Charges	1 Liter SUMMA Canister Preparation (1) @ \$10.00 each.	\$10.00
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CERTIFIED BY: Diana J. Schenfeld
 Laboratory Director

DATE: 3/30/94

AIR TOXICS LTD.SAMPLE NAME: EG3-EAFB2-1
ID#: 9403205-01A**EPA METHOD TO-3**
(Aromatic Volatile Organics in Air)**GC/PID**

File Name:	6032422	Date of Collection: 3/21/94		
Dil. Factor:	2.1	Date of Analysis: 3/24/94		
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.002	0.007	Not Detected	Not Detected
Toluene	0.002	0.008	Not Detected	Not Detected
Ethyl Benzene	0.002	0.009	Not Detected	Not Detected
Total Xylenes	0.002	0.009	0.027	0.12

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6032422	Date of Collection: 3/21/94		
Dil. Factor:	2.1	Date of Analysis: 3/24/94		
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	0.021	0.14	2.0	13
C2 - C4** Hydrocarbons	0.021	0.038	Not Detected	Not Detected

*TPH referenced to Jet Fuel (MW=156)

**C2 - C4 Hydrocarbons referenced to Propane (MW=44)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank
ID#: 9403205-02A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6032406	Date of Collection: NA		
Dil. Factor:	1.0	Date of Analysis: 3/24/94		
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.001	0.003	Not Detected	Not Detected
Toluene	0.001	0.004	Not Detected	Not Detected
Ethyl Benzene	0.001	0.004	Not Detected	Not Detected
Total Xylenes	0.001	0.004	Not Detected	Not Detected

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6032406	Date of Collection: NA		
Dil. Factor:	1.0	Date of Analysis: 3/24/94		
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	0.010	0.065	Not Detected	Not Detected
C2 - C4** Hydrocarbons	0.010	0.018	Not Detected	Not Detected

*TPH referenced to Jet Fuel (MW=156)

**C2 - C4 Hydrocarbons referenced to Propane (MW=44)

Container Type: NA

ENGINEERING SCIENCE

CHAIN OF CUSTODY RECORD

940320252

Distribution Original Accompanies Shipment. Yellow Copy Returned With Report.

APPENDIX B

ANALYTICAL DATA FOR AIR SAMPLES AT FT-28

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9403143

Work Order Summary

CLIENT: Ms. Diana Schenfeld
 Engineering Science
 1700 Broadway, Suite 900
 Denver, CO 80290

BILL TO: Same

PHONE: 303-831-8100
FAX: 303-831-8208
DATE RECEIVED: 3/17/94
DATE COMPLETED: 3/24/94

INVOICE # 3239
P.O. # DE268.43.04
PROJECT # DE268.43.04 Eglin AFB
AMOUNT\$: \$390.00

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	PRICE
01A	EG2-VW	TO-3	1.0 "Hg	\$120.00
02A	EG2-MPA-Shallow	TO-3	1.0 "Hg	\$120.00
03A	EG2-MPC-Deep	TO-3	1.5 "Hg	\$120.00
04A	Lab Blank	TO-3	NA	NC

Misc. Charges	1 Liter SUMMA Canister Preparation (3) @ \$10.00 each.	\$30.00
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CERTIFIED BY: *Diana Schenfeld*
 Laboratory Director

DATE: 3/24/94

AIR TOXICS LTD.SAMPLE NAME: EG2-VW
ID#: 9403143-01A**EPA METHOD TO-3**
(Aromatic Volatile Organics in Air)**GC/PID**

File Name:	6031711			Date of Collection: 3/16/94
Dil. Factor:	260			Date of Analysis: 3/17/94
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.26	0.84	94	300
Toluene	0.26	1.0	52	200
Ethyl Benzene	0.26	1.1	20	88
Total Xylenes	0.26	1.1	76	340

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031711			Date of Collection: 3/16/94
Dil. Factor:	260			Date of Analysis: 3/17/94
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	2.6	17	11000	71000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: EG2-MPA-Shallow
ID#: 9403143-02A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6031712			Date of Collection: 3/16/94
Dil. Factor:	260			Date of Analysis: 3/17/94
Compound		Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)
Benzene		0.26	0.84	93
Toluene		0.26	1.0	24
Ethyl Benzene		0.26	1.1	20
Total Xylenes		0.26	1.1	64
				300
				92
				88
				280

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031712			Date of Collection: 3/16/94
Dil. Factor:	260			Date of Analysis: 3/17/94
Compound		Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)
TPH*		2.6	17	11000
				71000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: EG2-MPC-Deep
ID#: 9403143-03A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6031713	Date of Collection: 3/16/94		
Dil. Factor:	530	Date of Analysis: 3/17/94		
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.53	1.7	250	810
Toluene	0.53	2.0	460	1800
Ethyl Benzene	0.53	2.3	47	210
Total Xylenes	0.53	2.3	220	970

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031713	Date of Collection: 3/16/94		
Dil. Factor:	530	Date of Analysis: 3/17/94		
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	5.3	34	26000	170000

*TPH referenced to Jet Fuel (MW=156)

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank
ID#: 9403143-04A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	6031705	Date of Collection: NA		
Dil. Factor:	1.0	Date of Analysis: 3/17/94		
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.001	0.003	Not Detected	Not Detected
Toluene	0.001	0.004	Not Detected	Not Detected
Ethyl Benzene	0.001	0.004	Not Detected	Not Detected
Total Xylenes	0.001	0.004	Not Detected	Not Detected

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	6031705	Date of Collection: NA		
Dil. Factor:	1.0	Date of Analysis: 3/17/94		
Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH*	0.010	0.065	Not Detected	Not Detected

*TPH referenced to Jet Fuel (MW=156)

Container Type: NA

9403143

FIGURE B.3

CHAIN OF CUSTODY RECORD

ENGINEERING-SCIENCE, INC.		APCEC BROADVIEW FIELD TESTS		Shp To:																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
Bldg: EGCLN AFB 1000 Broadway, Suite 600 Denver, Colorado 80203 (303) 831-8100		Bldg: OLD EGCLN FTA Job No. 43-04 # spclt(s): (Signature) OCA AWOSKA of G. STEVE RATTAF		Air Toxics Ltd. 180 Blue Ravine Rd. Suite B Folsom California 95630 Attn: Alexis Merdith																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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I.D.</th> <th>Sample Type</th> <th>Method</th> </tr> </thead> <tbody> <tr><td>1</td><td>EG 2 - V6U</td><td>C</td><td>AIR</td></tr> <tr><td>2</td><td>EG 2 - MP-A - SHALLOW</td><td>C</td><td>AIR</td></tr> <tr><td>3</td><td>EG 2 - MP-C - DEEP</td><td>C</td><td>AIR</td></tr> <tr><td>4</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>5</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>6</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>7</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>8</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>9</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>10</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>11</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>12</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>13</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>14</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>15</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>16</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>17</td><td></td><td>C</td><td>AIR</td></tr> 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<tr><td>401</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>402</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>403</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>404</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>405</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>406</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>407</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>408</td><td></td><td>C</td><td>AIR</td></tr> <tr><td>409</td><td></td><td>C</td><td>A</td></tr></tbody></table>						Sample Description		Remarks		No.	Lab. 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ANALYTICAL DATA FOR SOILS AT FT-28 AND FT-39

SOIL

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FINAL REPORT FOR SAMPLES RECEIVED: 03/07/94

FOR

EGLIN AFB
SITE: OLD EGLIN FTA

PACE PROJECT NUMBER: 730307502

PREPARED FOR:

ENGINEERING SCIENCE, INC.
1700 BROADWAY
SUITE 900
DENVER, COLORADO 80290

① Ola Awosika
ES - Atlanta
② Battle - Lisa
③ Original to Doanne & FIP

APRIL, 1994

PREPARED BY:

PACE INCORPORATED
5702 BOLSA AVENUE
HUNTINGTON BEACH, CALIFORNIA 92649

CONTRACT NO. DE-268.19.06.08

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- SECTION II. CHAIN OF CUSTODY**
- SECTION III. CROSS REFERENCE TABLE**
- SECTION IV. INORGANIC SECTION**
 - TOTAL RECOVERABLE
PETROLEUM HYDROCARBONS
DATA PACKAGE**
 - IRON DATA PACKAGE**
 - WET CHEMISTRY DATA PACKAGE**
- SECTION V. ORGANIC SECTION**
 - SW8020 (BTEX) DATA PACKAGE**
- SECTION VI. GLOSSARY OF ACRONYMS AND
SYMBOLS**
- SECTION VII. SUBCONTRACTED ANALYSIS**
 - TOTAL KJELDAHL NITROGEN**
 - PHOSPHATE**
 - SOIL CLASSIFICATION**

00003

SECTION I

COVER LETTER

April 7, 1994

Mr. Doug Downey
ENGINEERING SCIENCE - DENVER
1700 Broadway, Suite 900
Denver, Colorado 80290

Re: PACE Project No. 740307.502
Client Reference: AFCEE-EGLIN AFB

Dear Mr. Downey:

Enclosed is the report of laboratory analysis for three (3) soil samples received on March 7, 1994. These samples were delivered by Federal Express and received by PACE-Huntington Beach. The Chain of Custody indicated these samples to be analyzed for pH, alkalinity, iron, moisture content, BTEX, and TRPH using methods SW9045, A403(M), SW7380, D2216, SW8020, and E418.1, respectively. Total Kjedahl Nitrogen, phosphate and soil classification were subcontracted out to Sequoia Analytical in Redwood City, CA. All results are reported on a dry-weight basis.

A glossary of acronyms and symbols are found in Section VI.

If you have any questions regarding this report, please feel free to contact us.

Sincerely,

Melanie R. Concepcion
Project Manager
PACE-Southern California

THESE DATA HAVE BEEN REVIEWED AND ARE APPROVED FOR RELEASE.

Kenneth D. Faust
Regional Director
PACE-Southern California

740307.502

for

0110005

SECTION II
CHAIN OF CUSTODY

730307.502

FIGURE B-2

CHAIN OF CUSTODY RECORD

ENGINEERING-SCIENCE, INC. 100 BROADWAY, SUITE 300 DENVER, COLORADO 80238 303-431-4100	AFCEE BROWNTING PILOT TESTS EG LIN AFGB Site: old EG LIN FTA (EG 2) ES Job No. DE268.43 .08
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COLA 4- A WOSICA
of Shoreline:

000007

SECTION III
CROSS REFERENCE TABLE

000008

FIELD/LABORATORY IDENTIFIER CROSS-REFERENCE TABLE			
PACE PROJECT NUMBER: 740307502			
DATE COLLECTED	DATE RECEIVED	PACE SAMPLE IDENTIFIER	FIELD SAMPLE IDENTIFIER
03/03/94	03/07/94	750031647	EG2-VW-3'
03/04/94	03/07/94	750031655	EG2-VMPA-39'
03/04/94	03/07/94	750031663	EG2-VMPB-2-4'

006069

SECTION IV
INORGANIC SECTION

000010

**TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
DATA PACKAGE**

066011

REPORT OF LABORATORY ANALYSIS

EPA Method: E418.1 AFIID: EGLIN
 Ext/Prep Method: SW3550 LOCID: NA
 Project: 740307502
 PACE Sample ID: 750031647 Contract/Donum: NA
 Batch ID: 7511962
 Client Sample ID: EG2-VW-3'
 Date Collected: 03-Mar-94 SBD: 0
 Date Received: 07-Mar-94 SED: 0
 Date Ext/Prep: 12-Mar-94 SACODE: N1
 Date Analyzed: 14-Mar-94
 Matrix: Soil Percent Moisture: 6.0
 Dilution Factor: 25

Compound	Result	(MG/KG)		PQL
Total Petroleum Hydrocarbons	2210			133
End Of Results For Method				

000012

REPORT OF LABORATORY ANALYSIS

EPA Method: E418.1 AFIID: EGLIN
 Ext/Prep Method: SW3550 LOCID: NA
 Project: 740307502
 PACE Sample ID: 750031655 Contract/Donum: NA
 Batch ID: 7511962
 Client Sample ID: EG2-VMPA-39
 Date Collected: 04-Mar-94 SBD: 0
 Date Received: 07-Mar-94 SED: 0
 Date Ext/Prep: 12-Mar-94 SACODE: N1
 Date Analyzed: 14-Mar-94
 Matrix: Soil Percent Moisture: 7.0
 Dilution Factor: 25

Compound	(MG/KG)		
	Result	PQL	
Total Petroleum Hydrocarbons	3370		134
End Of Results For Method			

000013

REPORT OF LABORATORY ANALYSIS

EPA Method: E418.1 AFIID: EGLIN
 Ext/Prep Method: SW3550 LOCID: NA
 Project: 740307502
 PACE Sample ID: 750031663 Contract/Donum: NA
 Batch ID: 7511962
 Client Sample ID: EG2-VMPB-2-4'
 Date Collected: 04-Mar-94 SBD: 0
 Date Received: 07-Mar-94 SED: 0
 Date Ext/Prep: 12-Mar-94 SACODE: N1
 Date Analyzed: 14-Mar-94
 Matrix: Soil Percent Moisture: 7.6
 Dilution Factor: 50

Compound	Result	(MG/KG)		PQL
Total Petroleum Hydrocarbons	6610			270
End Of Results For Method				

666614

REPORT OF LABORATORY ANALYSIS

EPA Method: E418.1 AFIID: EGLIN
 Ext/Prep Method: METHOD LOCID: LABQC
 Project: QC
 PACE Sample ID: 758270217 Contract/Donum: NA
 Batch ID: 7511962
 Client Sample ID: Method Blank
 Date Collected: NA SBD: 0
 Date Received: NA SED: 0
 Date Ext/Prep: 12-Mar-94 SACODE: LB1
 Date Analyzed: 14-Mar-94
 Matrix: Soil/Solid Quality Control Matrix Percent Moisture: 0
 Dilution Factor: 1

Compound	(MG/KG)		
	Result		PQL
Total Petroleum Hydrocarbons	ND		5
End Of Results For Method			

010015

LAB Q.C. BATCH/FIELD I.D.

CROSS-REFERENCE TABLE

PACE Project Number: 740307502

QC BATCH IDENTIFIER	DATE ANALYZED	ANALYTICAL METHOD	PACE SAMPLE IDENTIFIER	FIELD SAMPLE IDENTIFIER
7511962	14-MAR-94	E418.1	750031655	EG2-VMPA-39'
7511962	14-MAR-94	E418.1	750031663	EG2-VMPB-2-4'
7511962	14-MAR-94	E418.1	750031647	EG2-VW-3'

QUALITY CONTROL REPORT

Analytical Method: E418.1
Analytical Batch ID: 7511962
Date of Analysis: 03/14/94
Instrument ID: IR #1
Calibration Reference #: 02/18/94

Solid X
Water -

Field Sample ID
EG2 - VW-3
EG2 - VMPA-39
EG2 - VMPB-2-4

Quality Control Samples	Target Concentrations (MG/KG)	Recovery (%)				RPD (%)	Corrective Action
		Spike	Duplicate	Control Limits	Results		
Laboratory Control Sample List Of Analytes Total Petroleum Hydrocarbons	208	88	91	75-125	3	50	

000017

IRON DATA PACKAGE

000018

REPORT OF LABORATORY ANALYSIS

EPA Method: SW7380 AFIID: EGLIN
 Ext/Prep Method: SW3050 LOCID: NA
 Project: 740307502
 PACE Sample ID: 750031647 Contract/Donum: NA
 Batch ID: 7512062
 Client Sample ID: EG2-VW-3
 Date Collected: 03-Mar-94 SBD: 0
 Date Received: 07-Mar-94 SED: 0
 Date Ext/Prep: 16-Mar-94 SACODE: N1
 Date Analyzed: 21-Mar-94
 Matrix: Soil Percent Moisture: 6.0
 Dilution Factor: 10

Compound	(MG/KG)		
	Result	PQL	
Iron	2560		200
End Of Results For Method			

010019

REPORT OF LABORATORY ANALYSIS

EPA Method: SW7380 AFIID: EGLIN
 Ext/Prep Method: SW3050 LOCID: NA
 Project: 740307502
 PACE Sample ID: 750031655 Contract/Donum: NA
 Batch ID: 7512062
 Client Sample ID: EG2-VMPA-39
 Date Collected: 04-Mar-94 SBD: 0
 Date Received: 07-Mar-94 SED: 0
 Date Ext/Prep: 16-Mar-94 SACODE: N1
 Date Analyzed: 21-Mar-94
 Matrix: Soil Percent Moisture: 7.0
 Dilution Factor: 1

Compound	Result	(MG/KG)		PQL
Iron	135			20
End Of Results For Method				

000020

REPORT OF LABORATORY ANALYSIS

EPA Method: SW7380 AFIID: EGLIN
Ext/Prep Method: SW3050 LOCID: NA
Project: 740307502
PACE Sample ID: 750031663 Contract/Donum: NA
Batch ID: 7512062
Client Sample ID: EG2-VMPB-2-4'

Date Collected: 04-Mar-94 SBD: 0
Date Received: 07-Mar-94 SED: 0
Date Ext/Prep: 16-Mar-94 SACODE: N1
Date Analyzed: 21-Mar-94

Matrix: Soil Percent Moisture: 7.6
Dilution Factor: 8

Compound	Result	(MG/KG)	
			PQL
Iron	2100		170
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

000021

EPA Method: SW7380 AFIID: EGLIN
Ext/Prep Method: SW3050 LOCID: LABQC
Project: QC
PACE Sample ID: 758272821 Contract/Donum: NA
Batch ID: 7512062
Client Sample ID: Method Blank

Date Collected: NA SBD: 0
Date Received: NA SED: 0
Date Ext/Prep: 21-Mar-94 SACODE: LB1
Date Analyzed: 21-Mar-94

Matrix: Soil/Solid Quality Control Matrix Percent Moisture: 0
Dilution Factor: 1

Compound	(MG/KG)		
	Result	PQL	
Iron	ND		20
End Of Results For Method			

000022

LAB Q.C. BATCH/FIELD I.D.

CROSS-REFERENCE TABLE

PACE Project Number: 740307502

QC BATCH IDENTIFIER	DATE ANALYZED	ANALYTICAL METHOD	PACE SAMPLE IDENTIFIER	FIELD SAMPLE IDENTIFIER
7512062	21-MAR-94	SW7380	750031655	EG2-VMPA-39'
7512062	21-MAR-94	SW7380	750031663	EG2-VMPB-2-4'
7512062	21-MAR-94	SW7380	750031647	EG2-VW-3'

QUALITY CONTROL REPORT

Analytical Method: SW7380
Analytical Batch ID: 7512062
Date of Analysis: 03/21/94
Instrument ID: FAA #1
Calibration Reference #: 03/21/94

Field Sample ID
EG2 - VW - 3
EG2 - VMPA - 39
EG2 - VMPB - 2 - 4

Solid X
Water -

Quality Control Samples	Target Concentrations (MG/KG)	Recovery (%)				RPD (%)	
		Spike	Duplicate	Control Limits	Results	Control Limits	Corrective Action
Laboratory Control Sample List Of Analytics	500	105	107	80-120	2	50	
Iron							

000024

WET CHEMISTRY DATA PACKAGE

000025

REPORT OF LABORATORY ANALYSIS

EPA Method: SM403(M) AFIID: EGLIN
Ext/Prep Method: METHOD LOCID: NA
Project: 740307502
PACE Sample ID: 750031647 Contract/Donum: NA
Batch ID: 7512016
Client Sample ID: EG2-VW-3'

Date Collected: 03-Mar-94 SBD: 0
Date Received: 07-Mar-94 SED: 0
Date Ext/Prep: 16-Mar-94 SACODE: N1
Date Analyzed: 16-Mar-94

Matrix: Soil Percent Moisture: 6.0
Dilution Factor: 1

Compound	(MG/KG)		
	Result	PQL	
Alkalinity, Total (As CaCO3)	354		42
End Of Results For Method			

000026

REPORT OF LABORATORY ANALYSIS

EPA Method: SM403(M) AFIID: EGLIN
Ext/Prep Method: METHOD LOCID: NA
Project: 740307502
PACE Sample ID: 750031655 Contract/Donum: NA
Batch ID: 7512016
Client Sample ID: EG2-VMPA-39'

Date Collected: 04-Mar-94 SBD: 0
Date Received: 07-Mar-94 SED: 0
Date Ext/Prep: 16-Mar-94 SACODE: N1
Date Analyzed: 16-Mar-94

Matrix: Soil Percent Moisture: 7.0
Dilution Factor: 1

Compound	(MG/KG)		
	Result	PQL	
Alkalinity, Total (As CaCO3)	ND		42
End Of Results For Method			

000027

REPORT OF LABORATORY ANALYSIS

EPA Method: SM403(M) AFIID: EGLIN
Ext/Prep Method: METHOD LOCID: NA
Project: 740307502
PACE Sample ID: 750031663 Contract/Donum: NA
Batch ID: 7512016
Client Sample ID: EG2-VMPB-2-4'

Date Collected: 04-Mar-94 SBD: 0
Date Received: 07-Mar-94 SED: 0
Date Ext/Prep: 16-Mar-94 SACODE: N1
Date Analyzed: 16-Mar-94

Matrix: Soil Percent Moisture: 7.6
Dilution Factor: 1

Compound	(MG/KG)		
	Result	PQL	
Alkalinity, Total (As CaCO3)	128		43
End Of Results For Method			

0610028

REPORT OF LABORATORY ANALYSIS

EPA Method: SM403(M) AFIID: EGLIN
 Ext/Prep Method: METHOD LOCID: LABQC
 Project: QC
 PACE Sample ID: 758271744 Contract/Donum: NA
 Batch ID: 7512016
 Client Sample ID: Method Blank
 Date Collected: NA SBD: 0
 Date Received: NA SED: 0
 Date Ext/Prep: 16-Mar-94 SACODE: LB1
 Date Analyzed: 16-Mar-94
 Matrix: Soil/Solid Quality Control Matrix Percent Moisture: 0
 Dilution Factor: 1

Compound	(MG/KG)		
	Result	PQL	
Alkalinity, Total (As CaCO ₃)	ND		40
End Of Results For Method			

0010029

LAB Q.C. BATCH/FIELD I.D.
CROSS-REFERENCE TABLE

PACE Project Number: 740307502

QC BATCH IDENTIFIER	DATE ANALYZED	ANALYTICAL METHOD	PACE SAMPLE IDENTIFIER	FIELD SAMPLE IDENTIFIER
7512016	16-MAR-94	SM403(M)	750031655	EG2-VMPA-39'
7512016	16-MAR-94	SM403(M)	750031663	EG2-VMPB-2-4'
7512016	16-MAR-94	SM403(M)	750031647	EG2-VW-3'

QUALITY CONTROL REPORT

Analytical Method: SM403(M)
Analytical Batch ID: 7512016
Date of Analysis: 03/16/94
Instrument ID: NA
Calibration Reference #: 03/16/94

Field Sample ID
EG2 - VW-3

Solid X
Water -

EG2 - VMPB-2-4'

000030

Quality Control Samples	Target Concentrations (MG/KG)	Recovery (%)				RPD (%)	Control Limits	Corrective Action
		Spike	Duplicate	Spike	Control Limits			
Laboratory Control Sample List Of Analytes	Alkalinity, Total (As CaCO ₃)	1760	97	95	75-125	2	50	

0110031

REPORT OF LABORATORY ANALYSIS

EPA Method: D2216 AFIID: EGLIN
Ext/Prep Method: METHOD LOCID: NA
Project: 740307502
PACE Sample ID: 750031647 Contract/Donum: NA
Batch ID: 7511886
Client Sample ID: EG2-VW-3'

Date Collected: 03-Mar-94 SBD: 0
Date Received: 07-Mar-94 SED: 0
Date Ext/Prep: 09-Mar-94 SACODE: N1
Date Analyzed: 09-Mar-94

Matrix: Soil Percent Moisture: 6.0
Dilution Factor: 1

Compound	(PERCENT)		
	Result	PQL	
Moisture, Percent	6		NA
End Of Results For Method			

000032

REPORT OF LABORATORY ANALYSIS

EPA Method: D2216 AFIID: EGLIN
Ext/Prep Method: METHOD LOCID: NA

PACE Sample ID: 750031655 Project: 740307502
Batch ID: 7511886 Contract/Donum: NA
Client Sample ID: EG2-VMPA-39'

Date Collected: 04-Mar-94 SBD: 0
Date Received: 07-Mar-94 SED: 0
Date Ext/Prep: 09-Mar-94 SACODE: N1
Date Analyzed: 09-Mar-94

Matrix: Soil Percent Moisture: 7.0
Dilution Factor: 1

Compound	(PERCENT)		
	Result	PQL	
Moisture, Percent	7		NA
End Of Results For Method			

REPORT OF LABORATORY ANALYSIS

000033

EPA Method: D2216 AFIID: EGLIN
Ext/Prep Method: METHOD LOCID: NA
Project: 740307502
PACE Sample ID: 750031663 Contract/Donum: NA
Batch ID: 7511886
Client Sample ID: EG2-VMPB-2-4'

Date Collected: 04-Mar-94 SBD: 0
Date Received: 07-Mar-94 SED: 0
Date Ext/Prep: 09-Mar-94 SACODE: N1
Date Analyzed: 09-Mar-94

Matrix: Soil Percent Moisture: 7.6
Dilution Factor: 1

Compound	(PERCENT)		
	Result	PQL	
Moisture, Percent	7.6		NA
End Of Results For Method			

000034

REPORT OF LABORATORY ANALYSIS

EPA Method: D2216 AFIID: EGLIN
Ext/Prep Method: METHOD LOCID: LABQC
Project: QC
PACE Sample ID: 758268646 Contract/Donum: NA
Batch ID: 7511886
Client Sample ID: Method Blank

Date Collected: NA SBD: 0
Date Received: NA SED: 0
Date Ext/Prep: 09-Mar-94 SACODE: LB1
Date Analyzed: 09-Mar-94

Matrix: Soil/Solid Quality Control Matrix Percent Moisture: 0
Dilution Factor: 1

Compound	(PERCENT)		
	Result	PQL	
Moisture, Percent	ND		NA
End Of Results For Method			

000035

REPORT OF LABORATORY ANALYSIS

EPA Method: SW9045 AFIID: EGLIN
 Ext/Prep Method: METHOD LOCID: NA
 Project: 740307502
 PACE Sample ID: 750031647 Contract/Donum: NA
 Batch ID: 7511924
 Client Sample ID: EG2-VW-3'
 Date Collected: 03-Mar-94 SBD: 0
 Date Received: 07-Mar-94 SED: 0
 Date Ext/Prep: 10-Mar-94 SACODE: N1
 Date Analyzed: 10-Mar-94
 Matrix: Soil Percent Moisture: 6.0
 Dilution Factor: 1

Compound	(PH UNITS)		
	Result	PQL	
pH	8.2		NA
End Of Results For Method			

000036

REPORT OF LABORATORY ANALYSIS

EPA Method: SW9045 AFIID: EGLIN
Ext/Prep Method: METHOD LOCID: NA
Project: 740307502
PACE Sample ID: 750031655 Contract/Donum: NA
Batch ID: 7511924
Client Sample ID: EG2-VMPA-39' SBD: 0
Date Collected: 04-Mar-94 SED: 0
Date Received: 07-Mar-94 SACODE: N1
Date Ext/Prep: 10-Mar-94
Date Analyzed: 10-Mar-94 Percent Moisture: 7.0
Matrix: Soil Dilution Factor: 1

Compound	(PH UNITS)		
	Result	PQL	
pH	6.6		NA
End Of Results For Method			

0110037

REPORT OF LABORATORY ANALYSIS

EPA Method: SW9045 AFIID: EGLIN
 Ext/Prep Method: METHOD LOCID: NA
 Project: 740307502
 PACE Sample ID: 750031663 Contract/Donum: NA
 Batch ID: 7511924
 Client Sample ID: EG2-VMPB-2-4'
 Date Collected: 04-Mar-94 SBD: 0
 Date Received: 07-Mar-94 SED: 0
 Date Ext/Prep: 10-Mar-94 SACODE: N1
 Date Analyzed: 10-Mar-94
 Matrix: Soil Percent Moisture: 7.6
 Dilution Factor: 1

Compound	(PH UNITS)		
	Result	PQL	
pH	7.8		NA
End Of Results For Method			

000038

SECTION V
ORGANICS SECTION

000039

SW8020 (BTEX) DATA PACKAGE

000040

REPORT OF LABORATORY ANALYSIS

EPA Method: SW8020 AFIID: EGLIN
 Ext/Prep Method: SW5030 LOCID: NA
 Project: 740307502
 PACE Sample ID: 750031647 Contract/Donum: NA
 Batch ID: 7511968
 Client Sample ID: EG2-VW-3'
 Date Collected: 03-Mar-94 SBD: 0
 Date Received: 07-Mar-94 SED: 0
 Date Ext/Prep: 08-Mar-94 SACODE: N1
 Date Analyzed: 08-Mar-94
 Matrix: Soil Percent Moisture: 6
 Dilution Factor: 10000

Compound	(MG/KG)		
	Result	PQL	
Benzene	10		5.3
Toluene	21		5.3
Ethylbenzene	24		5.3
Xylenes, Total	72		7.4
End Of Results For Method			

000041

REPORT OF LABORATORY ANALYSIS

EPA Method: SW8020 AFIID: EGLIN
 Ext/Prep Method: SW5030 LOCID: NA
 Project: 740307502
 PACE Sample ID: 750031655 Contract/Donum: NA
 Batch ID: 7511968
 Client Sample ID: EG2-VMPA-39'
 Date Collected: 04-Mar-94 SBD: 0
 Date Received: 07-Mar-94 SED: 0
 Date Ext/Prep: 08-Mar-94 SACODE: N1
 Date Analyzed: 08-Mar-94
 Matrix: Soil Percent Moisture: 7
 Dilution Factor: 125

Compound	(MG/KG)		
	Result		PQL
Benzene	0.15		0.067
Toluene	0.19		0.067
Ethylbenzene	0.4		0.067
Xylenes, Total	2.5		0.094
End Of Results For Method			

000042

REPORT OF LABORATORY ANALYSIS

EPA Method: SW8020 AFIID: EGLIN
Ext/Prep Method: SW5030 LOCID: NA
Project: 740307502
PACE Sample ID: 750031663 Contract/Donum: NA
Batch ID: 7511968
Client Sample ID: EG2-VMPB-2-4'
Date Collected: 04-Mar-94 SBD: 0
Date Received: 07-Mar-94 SED: 0
Date Ext/Prep: 08-Mar-94 SACODE: N1
Date Analyzed: 08-Mar-94
Matrix: Soil Percent Moisture: 7.6
Dilution Factor: 5000

Compound	(MG/KG)		
	Result	PQL	
Benzene	ND		2.7
Toluene	ND		2.7
Ethylbenzene	9.9		2.7
Xylenes, Total	22		3.8
End Of Results For Method			

000043

REPORT OF LABORATORY ANALYSIS

EPA Method: SW8020 AFIID: EGLIN
 Ext/Prep Method: SW5030 LOCID: LABQC
 Project: QC
 PACE Sample ID: 758270500 Contract/Donum: NA
 Batch ID: 7511968
 Client Sample ID: Method Blank
 Date Collected: NA SBD: 0
 Date Received: NA SED: 0
 Date Ext/Prep: 07-Mar-94 SACODE: LB1
 Date Analyzed: 07-Mar-94
 Matrix: Soil/Solid Quality Control Matrix Percent Moisture: 0
 Dilution Factor: 1

Compound	Result	(MG/KG)	
			PQL
Benzene	ND		0.0005
Toluene	ND		0.0005
Ethylbenzene	ND		0.0005
Xylenes, Total	ND		0.0007
End Of Results For Method			

000044

**REPORT OF LABORATORY ANALYSIS
SURROGATE PERCENT RECOVERY REPORT**

EPA Method: SW8020
Matrix: Soil
Batch ID: 7511968

AFB: VNBRG
Project: 740307502

Client Sample ID	PACE Sample No.	S1	Out of Limits
EG2-VW-3'	750031647	94	0
EG2-VMPA-39'	750031655	79	0
EGS-VMPB-2-4'	750031663	92	0
Method Blank	758270500	100	0
Laboaratory Control	758270535	102	0
LCS Duplicate	758270543	100	0

QC LIMITS

S1 = a,a,a-Trifluorotoluene 60-140

* = Values outside of Q.C. Limits

D = Surrogate diluted out

000045

LAB Q.C. BATCH/FIELD I.D.

CROSS-REFERENCE TABLE

PACE Project Number: 740307502

QC BATCH IDENTIFIER	DATE ANALYZED	ANALYTICAL METHOD	PACE SAMPLE IDENTIFIER	FIELD SAMPLE IDENTIFIER
7511968	08-MAR-94	SW8020	750031655	EG2-VMPA-39'
7511968	08-MAR-94	SW8020	750031663	EG2-VMPB-2-4'
7511968	08-MAR-94	SW8020	750031647	EG2-VW-3'

000046

QUALITY CONTROL REPORT

Analytical Method: SW8020
 Analytical Batch ID: 7511968
 Date of Analysis: 03/07/94
 Instrument ID: GC #4
 Calibration Reference #: 03/01/94

Field Sample ID
 EG2 - VW - 3
 EG2 - VMPA - 39
 EG2 - VMPB - 2 - 4

Quality Control Samples	Target Concentrations (MG/KG)	Recovery (%)				RPD (%)	Corrective Action
		Spike	Duplicate	Spike	Control Limits		
Laboratory Control Sample							
List Of Analytes							
Benzene	0.02	103	94	73-125	9	18	
Toluene	0.02	105	96	77-123	9	17	
Ethylbenzene	0.02	107	99	72-125	8	15	
Xylenes, Total	0.06	108	100	76-123	8	16	

000047

SECTION VI
GLOSSARY OF ACRONYMS AND SYMBOLS

000048

GLOSSARY OF
ACRONYMS AND SYMBOLS

<u>ACRONYM/SYMBOL</u>	<u>DEFINITION</u>
MDL	Method Detection Limit
NA	Not applicable.
NC	Not calculated.
ND	Not Detected
RPD	Relative Percent Difference.
D	Detectable.
J	Detected but below the PQL; therefore, result is an estimated concentration.
X	Please see NCR Ref. No.:___.

000049

SECTION VII
SUBCONTRACTED ANALYSIS



**Sequoia
Analytical**

680 Chesapeake Drive
1900 Bates Avenue, Suite L
819 Striker Avenue, Suite 8

Redwood City, CA 94063
Concord, CA 94520
Sacramento, CA 95834

(415) 364-9600
(510) 686-9600
(916) 921-9600

FAX (415) 364-9233
FAX (510) 686-9689
FAX (916) 921-0100

000050

Pace
5702 Bolsa Ave.
Huntington Beach, CA 92649
Attention: Melanie Concepcion

Client Project ID: EGLIN AFB
Sample Descript: Soil
Analysis for: Total Kjeldahl Nitrogen
First Sample #: 4C62601

Sampled: Mar 7, 1994
Received: Mar 8, 1994
Analyzed: Mar 16, 1994
Reported: Mar 23, 1994

LABORATORY ANALYSIS FOR: Total Kjeldahl Nitrogen

Sample Number	Sample Description	Detection Limit mg/kg	Sample Result mg/kg
4C62601	EG2-VW-3'(3-3)	43	N.D.
4C62602	EG2-VMPA-39'(3-4)	43	N.D.
4C62603	EG2-VMPB-2-4'(3-4)	43	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL


Tom Fowler
Project Manager

Please Note:
Sample results are reported on a dry weight basis. % moistures faxed by client 3-22-94.



**Sequoia
Analytical**

680 Chesapeake Drive Redwood City, CA 94063 (415) 364-9600 FAX (415) 364-9233
1900 Bates Avenue, Suite L Concord, CA 94520 (510) 686-9600 FAX (510) 686-9689
819 Striker Avenue, Suite 8 Sacramento, CA 95834 (916) 921-9600 FAX (916) 921-0100

000051

Pace
5702 Bolsa Ave.
Huntington Beach, CA 92649
Attention: Melanie Concepcion

Client Project ID: EGLIN AFB
Sample Descript: Soil
Analysis for: Phosphorus
First Sample #: 4C62601

Sampled: Mar 7, 1994
Received: Mar 8, 1994
Analyzed: Mar 17, 1994
Reported: Mar 23, 1994

LABORATORY ANALYSIS FOR: Phosphorus

Sample Number	Sample Description	Detection Limit mg/kg	Sample Result mg/kg
4C62601	EG2-VW-3'(3-3)	1.1	28
4C62602	EG2-VMPA-39'(3-4)	1.1	29
4C62603	EG2-VMPB-2-4'(3-4)	1.1	15

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Tom Fowler
Project Manager

Please Note:

Sample results are reported on a dry weight basis. % moisture faxed by client 3-22-94.
Samples were analyzed by 365.2.

000052



**Sequoia
Analytical**

680 Chesapeake Drive 1900 Bates Avenue, Suite L 819 Striker Avenue, Suite 8	Redwood City, CA 94063 Concord, CA 94520 Sacramento, CA 95834	(415) 364-9600 (510) 686-9600 (916) 921-9600	FAX (415) 364-9233 FAX (510) 686-9689 FAX (916) 921-0100
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Pace
5702 Bolsa Ave.
Huntington Beach, CA 92649
Attention: Melanie Concepcion

Client Project ID: EGLIN AFB
Matrix: Solid

QC Sample Group: 4C62601-03

Reported: Mar 23, 1994

QUALITY CONTROL DATA REPORT

ANALYTE	Total Kjeldahl Nitrogen	Phosphorous
Method:	EPA 351.4	EPA 365.2
Analyst:	S. Flynn	K. Newberry

MS/MSD Batch#:	4034751	4C27305
Date Prepared:	3/16/94	3/15/94
Date Analyzed:	3/16/94	3/15/94
Instrument I.D.#:	N/A	-
Conc. Spiked:	4000 mg/kg	100 mg/kg
Matrix Spike % Recovery:	109	90
Matrix Spike Duplicate % Recovery:	109	100
Relative % Difference:	0.0	11

LCS Batch#:	LCS031794
Date Prepared:	3/17/94
Date Analyzed:	3/17/94
Instrument I.D.#:	-

LCS % Recovery:	99
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% Recovery Control Limits:	60-140	60-140
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Please Note:

The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

SEQUOIA ANALYTICAL

Tom Fowler
Project Manager

000053

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: ASTM D422-63

Analyzed: 3/16/94

Lab ID: 9403626-01

Client ID: EG2-VW-3

SIEVE TEST

A. Total weight of sample:

212.91	g
2.35	g
98.90	%

Sample Description: SOIL

B. Weight retained in No.10 sieve:

C. % passing No.10 sieve:

**Sieve test for weight
retained in a No.10 sieve.**

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.26	0.12	0.12	99.88
No. 10	2.09	0.98	1.10	98.90
No. 200	193.33	90.80	91.91	8.09

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE DIAM. IN MM (S)
2	20	15	11	14.5	0.0368
5	20	14	10	14.7	0.0234
10	20	13	9	14.8	0.0166
15	20	13	9	14.8	0.0136
25	20	12	8	15	0.0106
40	20	12	8	15	0.0084
60	20	12	8	15	0.0068
90	20	12	8	15	0.0056
120	20	11	7	15.2	0.0049
1440	20	10	6	15.3	0.0014

% SUSPENDED (P)
9.5
8.6
7.7
7.7
6.9
6.9
6.9
6.9
6.0
5.2

Weight of soil used in hydrometer test (D):

115	g
1	
2.65	
3	
1	
0.01365	

Formulas:

$$R = H - E - F$$

$$S = K[\sqrt{L/T}]$$

$$P = (R/W)100$$

$$W = (J \times 100)/C$$

$$J = D \times G$$

Hydroscopic moisture correction factor (G):

Specific gravity (Assumed):

Dispersing agent correction factor (E):

Meniscus correction factor (F):

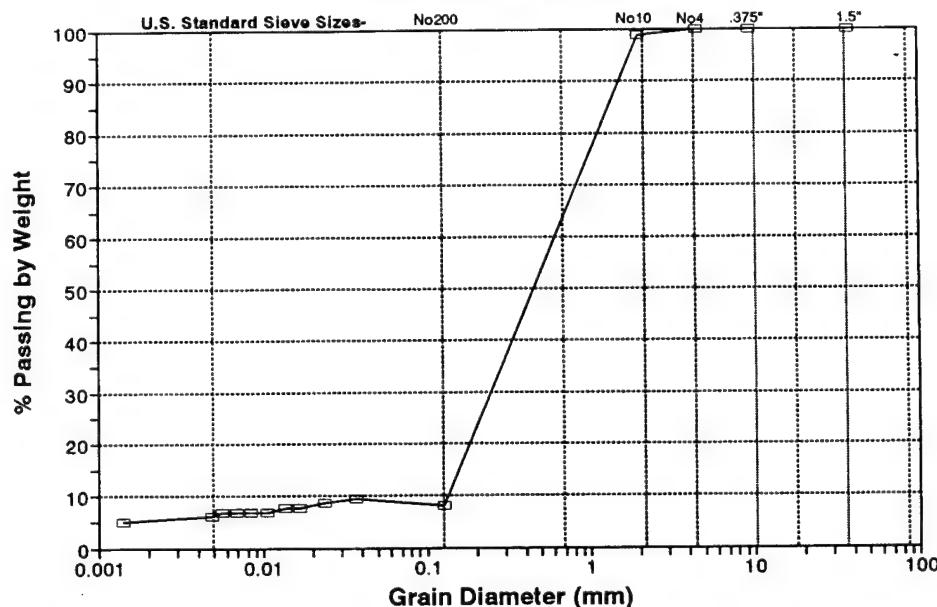
Temp./Spec. gravity dependant constant (K):



000054

Method: ASTM D422-63
 Analyzed: 3/16/94
 Lab ID: 9403626-01

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coars	Fine	Coarse	Cobbles
Fines			Sand			Gravel	

Graphing Data:	
Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	99.88
2	98.90
0.127	8.09
0.0368	9.46
0.0234	8.60
0.0166	7.74
0.0136	7.74
0.0106	6.88
0.0084	6.88
0.0068	6.88
0.0056	6.88
0.0049	6.02
0.0014	5.16

Sample Composition:

- (1) Gravel, passing 3-in. and retained on No. 4 sieve 0.1 %
- (2) Sand, passing No. 4 sieve and retained on No. 200 sieve 91.8 %
- (3) Silt size, 0.074 to 0.005 mm 2.1 %
- (4) Clay size, smaller than 0.005 mm 6.0 %

000055

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: **ASTM D422-63**

Analyzed: 3/16/94

Lab ID: 9403626-02

Client ID: **EG2-VMPA-39'****SIEVE TEST**

A. Total weight of sample:

239.58	g
0.09	g
99.96	%

Sample Description: SOIL

B. Weight retained in No.10 sieve:

C. % passing No.10 sieve:

**Sieve test for weight
retained in a No.10 sieve.**

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	0.09	0.04	0.04	99.96
No. 200	221.56	92.48	92.52	7.48

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE DIAM. in mm (S)
2	20	14	10	14.7	0.0370
5	20	9	5	15.5	0.0240
10	20	9	5	15.5	0.0170
15	20	9	5	15.5	0.0139
25	20	9	5	15.5	0.0107
40	20	9	5	15.5	0.0085
60	20	8	4	15.6	0.0070
90	20	8	4	15.6	0.0057
120	20	8	4	15.6	0.0049
1440	20	7	3	15.8	0.0014

% SUSPENDED (P)
8.7
4.3
4.3
4.3
4.3
3.5
3.5
3.5
2.6

Weight of soil used in hydrometer test (D):

115	g
1	
2.65	
3	
1	
0.01365	

Hydroscopic moisture correction factor (G):

Formulas:

$$R = H - E - F$$

Specific gravity (Assumed):

$$S = K[\sqrt{L/T}]$$

Dispersing agent correction factor (E):

$$P = (R/W)100$$

Meniscus correction factor (F):

$$W = (J \times 100)/C$$

Temp./Spec. gravity dependant constant (K):

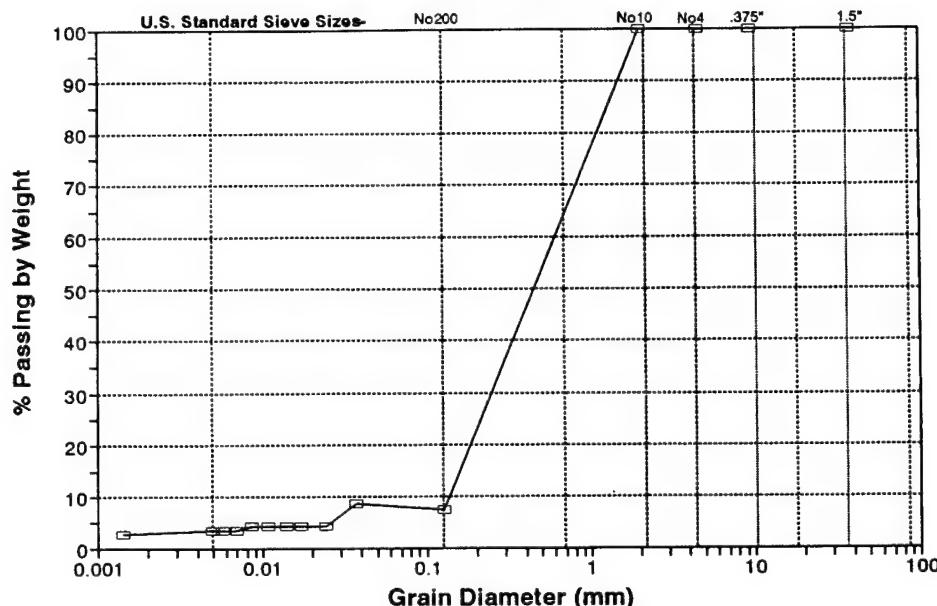
$$J = D \times G$$



000056

Method: ASTM D422-63
 Analyzed: 3/16/94
 Lab ID: 9403626-02

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coars	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	100.00
2	99.96
0.127	7.48
0.0370	8.69
0.0240	4.35
0.0170	4.35
0.0139	4.35
0.0107	4.35
0.0085	4.35
0.0070	3.48
0.0057	3.48
0.0049	3.48
0.0014	2.61

Sample Composition:

- (1) Gravel, passing 3-in. and retained on No. 4 sieve 0.0 %
- (2) Sand, passing No. 4 sieve and retained on No. 200 sieve 92.5 %
- (3) Silt size, 0.074 to 0.005 mm 4.0 %
- (4) Clay size, smaller than 0.005 mm 3.5 %

000057

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: ASTM D422-63

Analyzed: 3/16/94

Lab ID: 9403626-03

Client ID: EG2-VMPB-2-4

SIEVE TEST

A. Total weight of sample:

225.88	g
1.19	g
99.47	%

B. Weight retained in No.10 sieve:

C. % passing No.10 sieve:

Sample Description: SOIL

**Sieve test for weight
retained in a No.10 sieve.**

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	1.19	0.53	0.53	99.47
No. 200	207.01	91.65	92.17	7.83

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE DIAM. in mm (S)
2	20	14	10	14.7	0.0370
5	20	14	10	14.7	0.0234
10	20	13	9	14.8	0.0166
15	20	12	8	15	0.0137
25	20	12	8	15	0.0106
40	20	11	7	15.2	0.0084
60	20	11	7	15.2	0.0069
90	20	11	7	15.2	0.0056
120	20	11	7	15.2	0.0049
1440	20	10	6	15.3	0.0014

% SUSPENDED (P)
8.6
8.6
7.8
6.9
6.9
6.1
6.1
6.1
6.1
5.2

Weight of soil used in hydrometer test (D):

115	g
1	
2.65	
3	
1	
0.01365	

Hydroscopic moisture correction factor (G):

Specific gravity (Assumed):

Dispersing agent correction factor (E):

Meniscus correction factor (F):

Temp./Spec. gravity dependant constant (K):

Formulas:

$$R = H - E - F$$

$$S = K[\text{SQRT}(L/T)]$$

$$P = (R/W)100$$

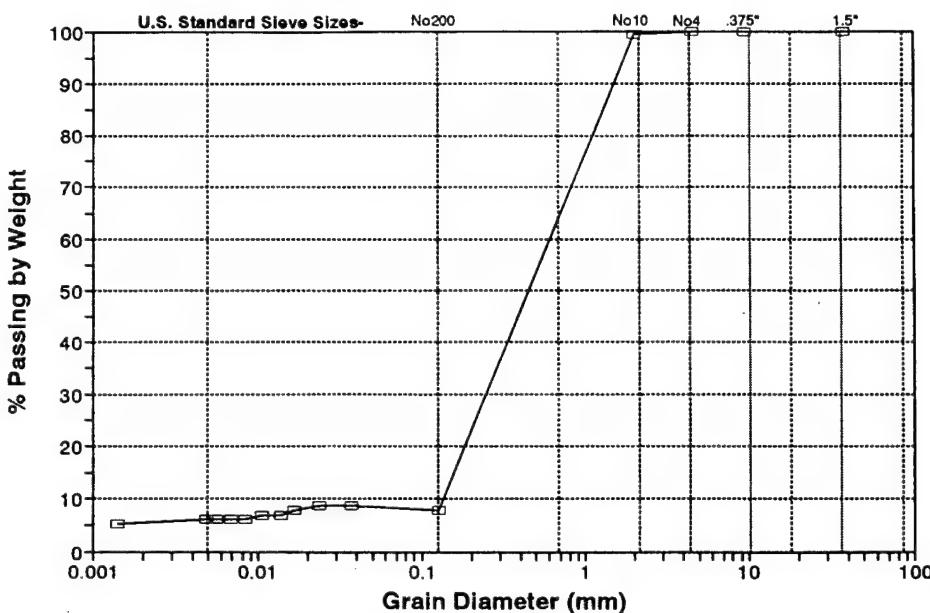
$$W = (J \times 100)/C$$

$$J = D \times G$$

000058

Method: ASTM D422-63
 Analyzed: 3/16/94
 Lab ID: 9403626-03

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coars	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	100.00
2	99.47
0.127	7.83
0.0370	8.65
0.0234	8.65
0.0166	7.78
0.0137	6.92
0.0106	6.92
0.0084	6.05
0.0069	6.05
0.0056	6.05
0.0049	6.05
0.0014	5.19

Sample Composition:

- (1) Gravel, passing 3-in. and retained on No. 4 sieve 0.0 %
- (2) Sand, passing No. 4 sieve and retained on No. 200 sieve 92.2 %
- (3) Silt size, 0.074 to 0.005 mm 1.8 %
- (4) Clay size, smaller than 0.005 mm 6.1 %



CHAIN-OF-CUSTODY RECORD
Analytical Request

Client Pace

Address

Report To: Melanie Ong Client No. _____

Pace Client No. _____

Pace Project Manager _____

Bill To: 740307-SO2

Pace Project No. 740307-SO2

P.O. # / Billing Reference 75-3444

Pace Request Due Date 3-21

Phone

Sampled By (PRINT):

Sampler Signature _____ Date Sampled _____

ITEM NO.	SAMPLE DESCRIPTION	TIME	MATRIX	PACE NO.	PRESERVATIVES				ANALYSES REQUEST	REMARKS
					UNPRESERVED	F.S.C.	HNO ₃	VQA		
1	EG2 - VW-3' (3-3)		Soil	1					X X X	140362601
2	EG2 - VMPA - 39' (3-4)		4	1					X X X	02
3	EG2 - VMPB - 2-4' (3-4)		4	1					X X X	03
4										
5										
6										
7										
8										
COOLER NOS.	BAIERS	SHIPMENT METHOD	OUT DATE	RETURNED DATE	ITEM NUMBER	RELINQUISHED BY/AFFILIATION	ACCEPTED BY/AFFILIATION	DATE	TIME	

Additional Comments

Mr. W. Pace V&P FEO Ex 3-2 1:300

Sherry 3-8-94 1:02

000

000

000

SEE REVERSE SIDE FOR INSTRUCTIONS



5702 Bolsa Avenue
Huntington Beach, CA 92649
TEL: 714 892-2565 FAX: 714 890-4032

P.1/5

Copy S. Archabal

Atlanta

OLA A WOS KA
57 Executive Park South
N.E.
Suite 590
Atlanta, GA
30329-2261

Fax Transmittal Cover Sheet

Date : 3-7-94To : DOUG DAWNEY At: ENGINEERING SCIENCEFax # : (303) 831-8208Total # of Pages (Including This Cover): 5PACE Project No./Department# : 740303.502Comments : _____

If you have questions regarding this fax transmission, please

Contact: Melanie Phone: (714) 892-2565Response Requested? Yes No

740303.502

CHAIN OF CUSTODY RECORD

DATE: 3/03/94
5:09 PMPACE
SOUTHERN CALIFORNIA REGION

PAGE: 2

Sample and Analysis Data Entry Form - New Sample(s)

Engineering-Science, Inc.

Client No : 521022

Mr. Doug Downey

: Client Contact

Project No: 740303.502 Due Date: 4/03/94 Client P.O. No:

Sample No: 75 003077.2 Collected Date: 3/02/94 ✓ Collected By: O. A.

Lab Rec'd Date: 3/03/94 ✓ Checked-In By: GHW Priority: 4

Due Date: 3/17/94 ✓ Sample Desc: EG3-MPB-5 ✓

Bottle Types: GM GN GN BT

Comnt: WALK P-1 (EGLIN APB-BIOVENT)

Matrix: SOIL

Analysis Abbr: Name:

AF-SPH ✓

pH

AF-ALK-S ✓

Alkalinity, Total (As CaCO₃)

SAFFAA-FE ✓

AIR FORCE FAA IRON

AF-MOIST ✓

Moisture, Percent

SAF-BTEX-B ✓

AIR FORCE AROMATIC VOLATILE ORGANICS

SAF-418.1 ✓

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

O-TKN ✓

Nitrogen, Total Kjeldahl

O-PO4 ✓

Total Phosphate

O-DISTCURV ✓

Grain Size Distribution Curve

MC
3-7 act

DATE: 3/03/94
5:09 PMPACE
SOUTHERN CALIFORNIA REGION

PAGE: 1

Sample and Analysis Data Entry Form - New Sample(s)

Engineering-Science, Inc.
 Mr. Doug Downey
 1700 Broadway, Suite 900
 Denver, CO. 80290

Client No : 521022
 : Client Contact
 : Address

303-831-8100
 303-831-8208

: Telephone No
 : FAX No

3/31/94

Project No: 740303.502 Due Date: 3/03/94 Client P.O. No:
 Project Manager: MRC Project Name: Eglin AFB
 Manager's Name: Melanie R. Concepcion
 Project Type: L
 QC Level: B Report Style: M
 Desc: TKN, Phos., Soil Class sent to Sequoia Labs.

Sample No: 75 003075.6 Collected Date: 3/01/94 Collected By: O. A.
 Lab Rec'd Date: 3/03/94 Checked-In By: GHW Priority: 4

Due Date: 3/17/94 Sample Desc: EG3-VN-6-8 ✓

Bottle Types: GM GN GN BT

Comnt: WALK P-1 (EGLIN AFB-BIOVENT) Matrix: SOIL

Analysis Abbr: Name:

AF-SPH ✓	pH
AP-ALK-S ✓	Alkalinity, Total (As CaCO ₃)
SAFFAA-FE ✓	AIR FORCE FAA IRON
AP-MOIST ✓	Moisture, Percent
SAF-BTEX-B ✓	AIR FORCE AROMATIC VOLATILE ORGANICS
SAF-418.1 ✓	AIR FORCE TOTAL PETROLEUM HYDROCARBONS
O-TKN ✓	Nitrogen, Total Kjeldahl
O-PO4 ✓	Total Phosphate
O-DISTCURV ✓	Grain Size Distribution Curve

Sample No: 75 003076.4 Collected Date: 3/02/94 Collected By: O. A.

Lab Rec'd Date: 3/03/94 Checked-In By: GHW Priority: 4

Due Date: 3/17/94 Sample Desc: EG3-MPA-3- 5 ✓

Bottle Types: GM GN GN BT

Comnt: WALK P-1 (EGLIN AFB-BIOVENT) Matrix: SOIL

Analysis Abbr: Name:

AF-SPH ✓	pH
AP-ALK-S ✓	Alkalinity, Total (As CaCO ₃)
SAFFAA-FE ✓	AIR FORCE FAA IRON
AP-MOIST ✓	Moisture, Percent
SAF-BTEX-B ✓	AIR FORCE AROMATIC VOLATILE ORGANICS
SAF-418.1 ✓	AIR FORCE TOTAL PETROLEUM HYDROCARBONS
O-TKN ✓	Nitrogen, Total Kjeldahl
O-PO4 ✓	Total Phosphate
O-DISTCURV ✓	Grain Size Distribution Curve

ML
3-7-94



Dear PACE Client:

The accompanying Sample and Analysis Data Entry form is provided to you as a part of the PACE Incorporated Quality Program. Please review the sample description(s) and analyses listed for each sample. Should there be any discrepancy between the sample and tests listed and the data you have requested, please notify our Client Service Coordinator immediately at (714) 892-2565.

All communications should reference the project number and the individual sample number. Please note the sample due date is for internal use only. The project due date is the scheduled date for completion of your analysis report.

PACE Incorporated reserves the right to dispose of all samples at our discretion. Our standard policy is to return all hazardous or potentially hazardous samples to the client upon completion of the project unless other arrangements are made prior to sample receipt.

If you have any questions, please contact our client services coordinator or me.

Sincerely,

A handwritten signature in black ink, appearing to read "KENNETH FAUST".

Kenneth Faust
Director
Southern California Region



5702 Bolsa Avenue
Huntington Beach, CA 92649
TEL: 714 892-2565 FAX: 714 890-4032

Fax Transmittal Cover Sheet

Date : 3-29-94

To : Doug Downey At: ENGINEERING SCIENCE

Fax # : (303) 831-8208

Total # of Pages (Including This Cover): 13

PACE Project No./Department# : AF

Comments : EGLIN AFB

*Scot H
PS
Mail
copy to
Ola Awosika
ES-AltInt*

If you have questions regarding this fax transmission, please

Contact: Melanie Conception Phone: (714) 892-2565

Response Requested? Yes No

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

March 29, 1994

PACE Project Number: 740307502

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290

Attn: Mr. Doug Downey

Client Reference: Eglin AFB

PACE Sample Number:

75 0031647

Date Collected:

03/03/94

Date Received:

03/07/94

Client Sample ID:

EG2-VW-3'

ParameterUnitsMDLMETHODDATE ANALYZEDSUBCONTRACT ANALYSTSINDIVIDUAL PARAMETERS

Grain Size Distribution Curve

SEE ATTACH ASTM D423

03/16/94

Nitrogen, Total Kjeldahl

mg/kg 43 ND 351.3

03/16/94

Total Phosphate

mg/kg 1.1 28 365.1

03/17/94

INORGANIC ANALYSISINDIVIDUAL PARAMETERSAlkalinity, Total (As CaCO₃)

MG/KG 42 354 SM403 (M)

03/16/94

Moisture, Percent

PERCENT 6.0 D2216

03/09/94

pH

PH UNITS 8.2 SW9045

03/10/94

AIR FORCE FAA IRONSoil FAA Metals Date Digested
Iron

SW7380

03/16/94
2560

03/21/94

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date

E418.1

Total Petroleum Hydrocarbons

03/12/94
2210

03/14/94

ORGANIC ANALYSISAIR FORCE AROMATIC VOLATILE ORGANICS

SW8020

Benzene

MG/KG 5.3 10

03/08/94

Toluene

MG/KG 5.3 21

03/08/94

Ethylbenzene

MG/KG 5.3 24

03/08/94

Xylenes, Total

MG/KG 7.4 72

03/08/94

a,a,a-Trifluorotoluene

PERCENT 94

03/08/94

Instrument ID #

4

03/08/94

Soil Prep Date

3/8/94

03/08/94

Dilution Factor

10000

03/08/94

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

March 29, 1994

PACE Project Number: 740307502

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290

Attn: Mr. Doug Downey

Client Reference: Eglin AFB

PACE Sample Number:

75 0031647

Date Collected:

03/03/94

Date Received:

03/07/94

Client Sample ID:

EG2-VW-3'

ParameterUnitsMDLMETHODDATE ANALYZEDSUBCONTRACT ANALYSTS

INDIVIDUAL PARAMETERS

Grain Size Distribution Curve

SEE ATTACH ASTM D422

03/16/94

Nitrogen, Total Kjeldahl

mg/kg

43

ND

351.3

03/16/94

Total Phosphate

mg/kg

1.1

28

365.1

03/17/94

INORGANIC ANALYSIS

INDIVIDUAL PARAMETERS

Alkalinity, Total (As CaCO₃)

MG/KG

42

354

SM403 (M)

03/16/94

Moisture, Percent

PERCENT

6.0

D2216

03/09/94

pH

PH UNITS

8.2

SW9045

03/10/94

AIR FORCE FAA IRON

Soil FAA Metals Date Digested
Iron

MG/KG

200

03/16/94

2560

03/21/94

SW7380

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date
Total Petroleum Hydrocarbons

MG/KG

133

03/12/94

2210

03/14/94

E418.1

ORGANIC ANALYSIS

AIR FORCE AROMATIC VOLATILE ORGANICS

Benzene
Toluene
Ethylbenzene
Xylenes, Total
a,a,a-Trifluorotoluene
Instrument ID #

MG/KG

5.3

10

03/08/94

MG/KG

5.3

21

03/08/94

MG/KG

5.3

24

03/08/94

MG/KG

7.4

72

03/08/94

PERCENT

94

03/08/94

4

03/08/94

Soil Prep Date
Dilution Factor

3/8/94

03/08/94

10000

03/08/94

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

Mr. Doug Downey
Page 2

March 29, 1994
PACE Project Number: 740307502

Client Reference: Eglin AFB

PACE Sample Number:
Date Collected:
Date Received:
Client Sample ID:
Parameter

75 0031655
03/04/94
03/07/94
EG2-VMPA-

<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	<u>39'</u>	<u>METHOD</u>	<u>DATE ANALYZED</u>
------------------	--------------	------------	------------	---------------	----------------------

SUBCONTRACT ANALYSIS

INDIVIDUAL PARAMETERS

Grain Size Distribution Curve
Nitrogen, Total Kjeldahl
Total Phosphate

			SEE ATTACH	ASTM D422	03/16/94
	mg/kg	43	ND	351.3	03/16/94
	mg/kg	1.1	29	365.1	03/17/94

INORGANIC ANALYSIS

INDIVIDUAL PARAMETERS

Alkalinity, Total (As CaCO₃)
Moisture, Percent
pH

	MG/KG	42	ND	SM403 (M)	03/16/94
	PERCENT		7.0	D2216	03/09/94
	PH UNITS		6.6	SW9045	03/10/94

AIR FORCE FAA IRON

Soil FAA Metals Date Digested
Iron

	MG/KG	20	ND	SW7380	03/16/94
			135		03/21/94

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date
Total Petroleum Hydrocarbons

	MG/KG	134	ND	E418.1	03/12/94
			3370		03/14/94

ORGANIC ANALYSIS

AIR FORCE AROMATIC VOLATILE ORGANICS

Benzene
Toluene
Ethylbenzene
Xylenes, Total
a,a,a-Trifluorotoluene
Instrument ID #

	MG/KG	0.067	0.15	SW8020	03/08/94
	MG/KG	0.067	0.19		03/08/94
	MG/KG	0.067	0.40		03/08/94
	MG/KG	0.094	2.5		03/08/94
	PERCENT		79		03/08/94
			4		03/08/94

Soil Prep Date
Dilution Factor

	3/8/94	125	03/08/94
			03/08/94

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

March 29, 1994
PACE Project Number: 740307502

Mr. Doug Downey
Page 3

Client Reference: Eglin AFB

PACE Sample Number:

75 0031663

Date Collected:

03/04/94

Date Received:

03/07/94

Client Sample ID:

EG2-VMPB-

Parameter

Units MDL 2-4' METHOD DATE ANALYZED

SUBCONTRACT ANALYSIS

INDIVIDUAL PARAMETERS

Grain Size Distribution Curve

SRE ATTACH

ASTM D422

03/16/94

Nitrogen, Total Kjeldahl

mg/kg 43 ND 351.3 03/16/94

Total Phosphate

mg/kg 1.1 15 365.1 03/17/94

INORGANIC ANALYSIS

INDIVIDUAL PARAMETERS

Alkalinity, Total (As CaCO₃)

MG/KG 43 128 SM403 (M) 03/16/94

Moisture, Percent

PERCENT 7.6 D2216 03/09/94

pH

PH UNITS 7.6 SW9045 03/10/94

AIR FORCE FAA IRON

Soil FAA Metals Date Digested

SW7380

Iron

MG/KG 170 03/16/94 2100 03/21/94

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date

E418.1

Total Petroleum Hydrocarbons

MG/KG 270 03/12/94 6610 03/14/94

ORGANIC ANALYSIS

AIR FORCE AROMATIC VOLATILE ORGANICS

SW8020

Benzene

MG/KG 2.7 ND 03/08/94

Toluene

MG/KG 2.7 ND 03/08/94

Ethylbenzene

MG/KG 2.7 9.9 03/08/94

Xylenes, Total

MG/KG 3.8 22 03/08/94

a,a,a-Trifluorotoluene

PERCENT 92 03/08/94

Instrument ID #

4 03/08/94

Soil Prep Date

3/8/94 03/08/94

Dilution Factor

5000 03/08/94

PRELIMINARY:
DATA PENDING

March 29, 1994 FINAL REVIEW
PACE Project Number: 740307502

Mr. Doug Downey
Page 4

Client Reference: Eglin AFB

These data have been reviewed and are approved for release.

Kenneth D. Faust,
Southern California Regional Director

Mr. Doug Downey
Page 5

FOOTNOTES
for pages 1 through 4

Client Reference: Eglin AFB

MDL Method Detection Limit
ND Not detected at or above the MDL.

PRELIMINARY:
DATA PENDING
FINAL REVIEW
March 29, 1994
PACE Project Number 740307502

730307. 503

FIGURE B.2

CHAIN OF CUSTODY RECORD

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

March 29, 1994
PACE Project Number: 740303502

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290

Attn: Mr. Doug Downey

Client Reference: Eglin AFB

PACE Sample Number:

75 0030756

Date Collected:

03/01/94

Date Received:

03/03/94

EG3-VW-6-8

Parameter

Units

MDL

METHOD

DATE ANALYZED

SUBCONTRACT ANALYSIS

INDIVIDUAL PARAMETERS

Grain Size Distribution Curve

SEE ATTACH ASTM D422

03/16/94

Nitrogen, Total Kjeldahl

mg/kg

40

ND

351.3

03/16/94

Total Phosphate

mg/kg

1.1

35

365.1

03/17/94

INORGANIC ANALYSIS

INDIVIDUAL PARAMETERS

Alkalinity, Total (As CaCO₃)

MG/KG

43

331

SM403 (M)

03/16/94

Moisture, Percent

PERCENT

6.9

D2216

03/09/94

pH

PH UNITS

8.1

SW9045

03/10/94

AIR FORCE FAA IRON

Soil FAA Metals Date Digested

SW7380

Iron

MG/KG

21

03/09/94

240

03/09/94

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date

E418.1

Total Petroleum Hydrocarbons

MG/KG

513

03/08/94

15800

03/08/94

ORGANIC ANALYSIS

AIR FORCE AROMATIC VOLATILE ORGANICS

SW8020

Benzene

MG/KG

0.54

ND

03/08/94

Toluene

MG/KG

0.54

15

03/08/94

Ethylbenzene

MG/KG

0.54

3.3

03/08/94

Xylenes, Total

MG/KG

0.75

26

03/08/94

a,a,a-Trifluorotoluene

PERCENT

60

4

03/08/94

Instrument ID #

Soil Prep Date

3/8/94

Dilution Factor

1000

03/08/94

03/08/94

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

March 29, 1994
PACE Project Number: 740303502

Mr. Doug Downey
Page 2

Client Reference: Eglin AFB

PACE Sample Number:	75 0030764				
Date Collected:	03/02/94				
Date Received:	03/03/94				
Client Sample ID:	EG3-MPA-3-				
<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	<u>5</u>	<u>METHOD</u>	<u>DATE ANALYZED</u>

SUBCONTRACT ANALYSIS

INDIVIDUAL PARAMETERS

Grain Size Distribution Curve	SEE ATTACH	ASTM D422	03/16/94		
Nitrogen, Total Kjeldahl	mg/kg	42	120	351.3	03/16/94
Total Phosphate	mg/kg	1.1	18	365.1	03/17/94

INORGANIC ANALYSIS

TNTTIVTUAI. PARAMETERS

Alkalinity, Total (As CaCO ₃)	MG/KG	42	253	SM403 (M)	03/16/94
Moisture, Percent	PERCENT		5.8	D2216	03/09/94
pH	PH UNITS		8.2	SW9015	03/10/94

AIR FORCE FAA IRON

Soil FAA Metals Date Digestcd	03/09/94				
Iron	MG/KG	40	620	SW7380	03/09/94

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date	03/08/94				
Total Petroleum Hydrocarbons	MG/KG	490	12100	E418.1	03/08/94

ORGANIC ANALYSIS

AIR FORCE AROMATIC VOLATILE ORGANICS

Benzene	MG/KG	2.6	ND	SW8020	03/08/94
Toluene	MG/KG	2.6	22		03/08/94
Ethylbenzene	MG/KG	2.6	14		03/08/94
Xylenes, Total	MG/KG	3.7	88		03/08/94
a,a,a-Trifluorotoluene	PERCENT		88		03/08/94
Instrument ID #			4		03/08/94

Soil Prep Date	3/8/94	03/08/94
Dilution Factor	5000	03/08/94

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

Mr. Doug Downey
Page 3

March 29, 1994
PACE Project Number: 740303502

Client Reference: Eglin AFB

PACE Sample Number:

75 0030772

Date Collected:

03/02/94

Date Received:

03/03/94

Client Sample ID:

EG3-MPB-5

Parameter

<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	<u>METHOD</u>	<u>DATE ANALYZED</u>
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SUBCONTRACT ANALYSIS

INDIVIDUAL PARAMETERS

Grain Size Distribution Curve

SEE ATTACH ASTM D422

03/16/94

Nitrogen, Total Kjeldahl

mg/kg 43 83 351.3 03/16/94

Total Phosphate

mg/kg 1.1 46 365.1 03/17/94

INORGANIC ANALYSIS

INDIVIDUAL PARAMETERS

Alkalinity, Total (As CaCO₃)

MG/KG 43 321 SM403 (M) 03/16/94

Moisture, Percent

PERCENT 7.1 D2216 03/09/94

pH

PH UNITS 8.2 SW9045 03/10/94

AIR FORCE FAA IRON

Soil FAA Metals Date Digested
Iron

SW7380

03/09/94 1160 03/09/94

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date

E418.1

Total Petroleum Hydrocarbons

03/08/94 MG/KG 10.6 848 03/08/94

ORGANIC ANALYSIS

AIR FORCE AROMATIC VOLATILE ORGANICS

Benzene

MG/KG 2.7 ND 03/08/94

Toluene

MG/KG 2.7 5.1 03/08/94

Ethylbenzene

MG/KG 2.7 4.5 03/08/94

Xylenes, Total

MG/KG 3.8 29 03/08/94

a,a,a-Trifluorotoluene

PERCENT 91 03/08/94

Instrument ID #

4 03/08/94

Soil Prep Date

3/8/94 03/08/94

Dilution Factor

5000 03/08/94

PRELIMINARY:
DATA PENDING

March 29, 1994
PACE Project Number: 740303502

FINAL REVIEW

Mr. Doug Downey
Page 4

Client Reference: Eglin AFB

These data have been reviewed and are approved for release.

Kenneth D. Faust,
Southern California Regional Director

PRELIMINARY:
DATA PENDING
~~FINAL REVIEW~~

Mr. Doug Downey
Page 5

FOOTNOTES
for pages 1 through 4

March 29, 1994
PACE Project Number 13038318202

Client Reference: Eglin AFB

MDL Method Detection Limit
ND Not detected at or above the MDL.



5702 Bolsa Avenue
Huntington Beach, CA 92649
TEL: 714 892-2565 FAX: 714 890-4032

Fax Transmittal Cover Sheet

Date : 3-29-94

To : OLA AWOSICA At: ENGINEERING, SCIENCE

Fax # : (404) 235-2500

Total # of Pages (Including This Cover): 25

PACE Project No./Department# : _____

Comments : 740303502 EGLIN AFB
740307502 K W

If you have questions regarding this fax transmission, please

Contact: Melanie Conception Phone: (714) 892-2565

Response Requested? Yes No

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

March 29, 1994
PACE Project Number: 740303502

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290

Attn: Mr. Doug Downey

Client Reference: Eglin AFB

PACE Sample Number:	75 0030756
Date Collected:	03/01/94
Date Received:	03/03/94
	EQ3-VW-6-8

<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	<u>METHOD</u>	<u>DATE ANALYZED</u>
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SUBCONTRACT ANALYSIS

INDIVIDUAL PARAMETERS

Grain Size Distribution Curve			SEE ATTACH ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	40	ND	351.3
Total Phosphate	mg/kg	1.1	35	365.1

INORGANIC ANALYSIS

INDIVIDUAL PARAMETERS

Alkalinity, Total (As CaCO ₃)	MG/KG	43	331	SM403 (M)	03/16/94
Moisture, Percent	PERCENT		6.9	D2216	03/09/94
pH	PH UNITS		8.1	SW9045	03/10/94

AIR FORCE FAA IRON

Soil FAA Metals Date Digested			03/09/94	SW7380
Iron	MG/KG	21	240	03/09/94

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date			03/08/94	8418.1
Total Petroleum Hydrocarbons	MG/KG	513	15800	03/08/94

ORGANIC ANALYSIS

AIR FORCE AROMATIC VOLATILE ORGANICS

Benzene	MG/KG	0.54	ND	03/08/94
Toluene	MG/KG	0.54	15	03/08/94
Ethylbenzene	MG/KG	0.54	3.3	03/08/94
Xylenes, Total	MG/KG	0.75	26	03/08/94
a,a,a-Trifluorotoluene	PERCENT		60	03/08/94
Instrument ID #			4	03/08/94

Soil Prep Date
Dilution Factor

3/8/94	03/08/94
1000	03/08/94

**PRELIMINARY;
DATA PENDING
FINAL REVIEW**

March 29, 1994
PACE Project Number: 740303502

Mr. Doug Downey
Page 2

Client Reference: Eglin AFB

PACE Sample Number:

75 0030764

Date Collected:

03/02/94

Date Received:

03/03/94

Client Sample ID:

EG3-MPA-3-

Parameter

Units

MDL

METHOD DATE ANALYZED

SUBCONTRACT ANALYSIS

INDIVIDUAL PARAMETERS

Grain Size Distribution Curve			SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	42	120	351.3	03/16/94
Total Phosphate	mg/kg	1.1	18	365.1	03/17/94

INORGANIC ANALYSIS

INDIVIDUAL PARAMETERS

Alkalinity, Total (As CaCO ₃)	MG/KG	42	253	SM403 (M)	03/16/94
Moisture, Percent	PERCENT		5.8	D2216	03/09/94
pH	PW UNITS		8.2	SW9043	03/10/94

AIR FORCE FAA IRON

Soil FAA Metals Date Digested			03/09/94	SW7380
Iron	MG/KG	40	620	03/09/94

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date			03/08/94	E418.1
Total Petroleum Hydrocarbons	MG/KG	490	12100	03/08/94

ORGANIC ANALYSIS

AIR FORCE AROMATIC VOLATILE ORGANICS

Benzene	MG/KG	2.6	ND	03/08/94
Toluene	MG/KG	2.6	22	03/08/94
Ethylbenzene	MG/KG	2.6	14	03/08/94
Xylenes, Total	MG/KG	3.7	88	03/08/94
a,a,a-Trifluorotoluene	PERCENT		88	03/08/94
Instrument ID #			4	03/08/94

Soil Prep Date

3/8/94

03/08/94

Dilution Factor

5000

03/08/94

MAR-29-1994 16:26 FROM PACE INCORPORATED

TO

14042352500 P.04

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

Mr. Doug Downey
Page 3

March 29, 1994
PACE Project Number: 740303502

Client Reference: Eglin AFB

PACE Sample Number:	75 0030772
Date Collected:	03/02/94
Date Received:	03/03/94
Client Sample ID:	SG3-MPB-5

<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	<u>METHOD</u>	<u>DATE ANALYZED</u>
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SUBCONTRACT ANALYSIS**INDIVIDUAL PARAMETERS**

Grain Size Distribution Curve			SRV ATTACH ASTM D432	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	43	83	351.3
Total Phosphate	mg/kg	1.1	46	365.1

INORGANIC ANALYSIS**INDIVIDUAL PARAMETERS**

Alkalinity, Total (As CaCO ₃)	MG/KG	43	321	SM403 (M)	03/16/94
Moisture, Percent	PERCENT		7.1	D2216	03/09/94
pH	PH UNITS		0.2	SW8045	03/10/94

AIR FORCE FAA IRON

Soil FAA Metals Date Digested			03/09/94	SW7380
Iron	MG/KG	81	1160	03/09/94

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date			03/08/94	E418.1
Total Petroleum Hydrocarbons	MG/KG	10.6	848	03/08/94

ORGANIC ANALYSIS**AIR FORCE AROMATIC VOLATILE ORGANICS**

Benzene	MG/KG	2.7	ND	SW8020
Toluene	MG/KG	2.7	5.1	03/08/94
Ethylbenzene	MG/KG	2.7	4.5	03/08/94
Xylenes, Total	MG/KG	3.8	29	03/08/94
a,a,a-Trifluorotoluene	PERCENT		91	03/08/94
Instrument ID #			4	03/08/94

Soil Prep Date			3/8/94	03/08/94
Dilution Factor			5000	03/08/94

MAR-29-1994 16:26 FROM PACE INCORPORATED

TO

14042352500 P.05

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

March 29, 1994
PACE Project Number: 740303502

Mr. Doug Downey
Page 4

Client Reference: Eglin AFB

These data have been reviewed and are approved for release.

Kenneth D. Faust,
Southern California Regional Director

Mr. Doug Downey
Page 5

FOOTNOTES
for pages 1 through 4

March 29, 1994
PACE Project Number A7040W02

Client Reference: Eglin AFB

MDL Method Detection Limit
ND Not detected at or above the MDL.

PRELIMINARY:
DATA PENDING
~~FINAL REVIEW~~

SEQUOIA ANALYTICAL LABORATORY

Particle Size Distribution by Sieve and Hydrometer

Method: ASTM D422-63

Analyzed: 3/15/94

Lab ID: 9403823-01

Client ID: EG3-VW-6--8

SIEVE TEST

- A. Total weight of sample: 170.03 g
 B. Weight retained in No.10 sieve: 0 g
 C. % passing No.10 sieve: 100.00 %

Sample Description: SOIL

Sieve test for weight
retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	0.00	0.00	0.00	100.00
No. 200	170.03	85.53	85.53	4.47

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	PARTICLE SIZE (mm)	SUSPENDED (%)	
					WATER (W)	SOIL (S)
2	20	14	10	14.7	0.0870	8.7
5	20	14	10	14.7	0.0234	8.7
10	20	8	4	18.5	0.0170	3.5
15	20	8	4	15.9	0.0139	3.5
20	20	7	3	15.8	0.0109	2.6
40	20	7	3	16.8	0.0086	2.6
80	20	7	3	15.8	0.0070	2.6
90	20	7	3	15.8	0.0067	2.6
120	20	7	3	15.8	0.0050	2.6
1440	20	7	3	15.8	0.0014	2.6

% SUSPENDED (%)
8.7
8.7
3.5
3.5
2.6
2.6
2.6
2.6
2.6
2.6
2.6

Weight of soil used in hydrometer test (D): 115 g

Hydrometer moisture correction factor (G): 1

Specific gravity (Assumed): 2.65

Dispersing agent correction factor (E): 3

Meniscus correction factor (F): 1

Temp./Spec. gravity dependant constant (K): 0.01365

115	g
1	
2.65	
3	
1	
0.01365	

Formulas:

$$R = H - E - F$$

$$S = K(PGT)(L/T)$$

$$P = (R/W)100$$

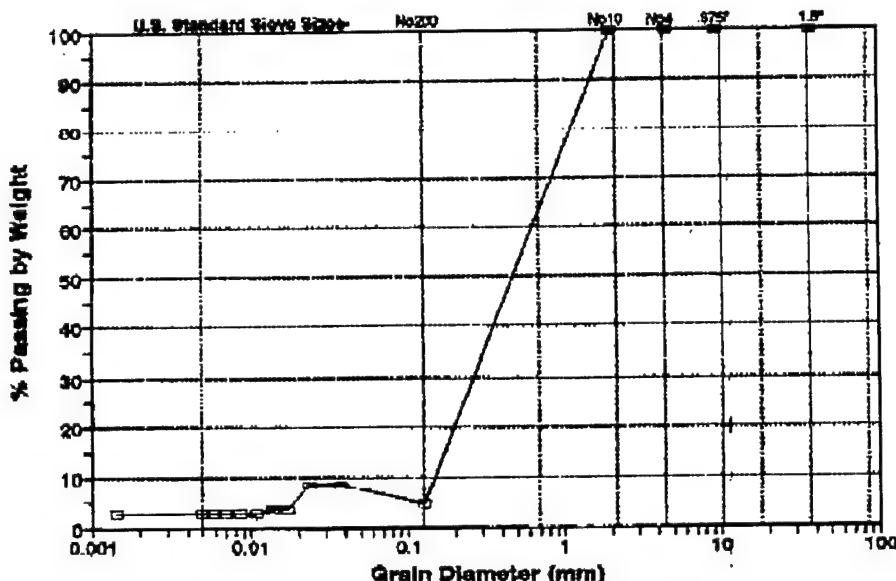
$$W = (L \times 100)/C$$

$$J = D \times G$$



Method: ASTM D422-63
 Analyzed: 3/16/94
 Lab ID: 9403623-01

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coarse	Fine	Coarse	Cobbles
		Sand			Gravel		
Fines							

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	100.00
2	100.00
0.127	4.47
0.0370	4.70
0.0234	8.70
0.0170	3.48
0.0139	3.48
0.0108	2.61
0.0080	2.61
0.0070	2.61
0.0057	2.61
0.0050	2.61
0.0014	2.61

Sample Composition:

- (1) Gravel, passing 3-in. and retained on No. 4 sieve 0.0 %
- (2) Sand, passing No. 4 sieve and retained on No. 200 sieve 85.5 %
- (3) Silt size, 0.074 to 0.005 mm 1.9 %
- (4) Clay size, smaller than 0.005 mm 2.6 %

SEQUOIA ANALYTICAL LABORATORY**Particle Size Distribution by Sieve and Hydrometer**

Method: ASTM D423-63

Analyzed: 3/16/94

Lab ID: 9403623-02

Client ID: EG3-MPA-3-5

SIEVE TEST

A. Total weight of sample:

129.18	g
0.47	g
99.64	%

Sample Description: SOIL

B. Weight retained in No.10 sieve:

C. % passing No.10 sieve:

Sieve test for weight
retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	0.47	0.36	0.36	99.64
No. 300	113.57	87.92	98.28	11.72

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (R)	(L)	PARTICLE SIZE IN (µ)
2	20	18	14	14	0.0361
5	20	17	13	14.2	0.0230
10	20	15	11	14.5	0.0164
15	20	14	10	14.7	0.0138
25	20	13	9	14.8	0.0105
40	20	12	8	15	0.0084
60	20	11	7	15.2	0.0066
80	20	11	7	15.2	0.0056
120	20	10	6	15.3	0.0049
1440	20	6	4	15.6	0.0014

% SUSPENDED (%)
12.1
11.3
9.5
8.7
7.8
6.9
6.1
6.1
5.2
3.5

Weight of soil used in hydrometer test (D):

115	g
1	
2.65	
3	
1	
0.01365	

Formulas:

$$R = H - E - F$$

$$G = K \rho G RT (L/T)$$

$$F = (R/W)100$$

$$W = (J \times 100)/G$$

$$J = D \times G$$

Hydroscopic moisture correction factor (G):

Specific gravity (Assumed):

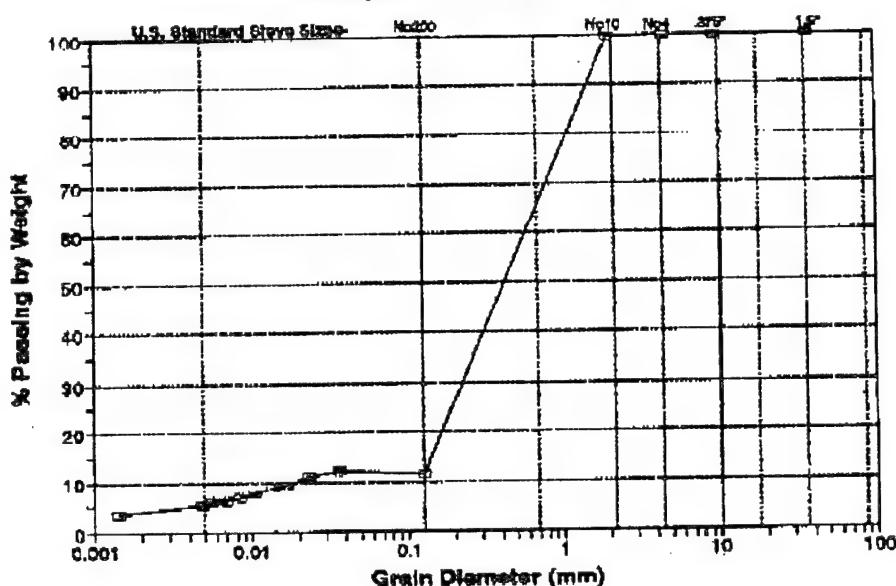
Dispersing agent correction factor (E):

Meniscus correction factor (F):

Temp./Spec. gravity dependant constant (K):

Method: ASTM D422-63
 Analyzed: 3/16/94
 Lab ID: 9409523-02

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coarse	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:	
Part. Diam.	Percent
(mm)	Suspended
37.5	100.00
9.5	100.00
4.5	100.00
2	99.64
0.127	11.72
0.0361	12.13
0.0230	11.26
0.0164	9.53
0.0135	8.66
0.0105	7.80
0.0084	6.93
0.0068	6.06
0.0056	5.06
0.0049	5.20
0.0014	3.47

Sample Composition:		
(1) Gravel, passing 3-in. and retained on No. 4 sieve	0.0	%
(2) Sand, passing No. 4 sieve and retained on No. 200 sieve	88.3	%
(3) Silt size, 0.074 to 0.005 mm	6.5	%
(4) Clay size, smaller than 0.005 mm	5.2	%

SEQUOIA ANALYTICAL LABORATORY**Particle Size Distribution by Sieve and Hydrometer**

Method: ASTM D422-63

Analyzed: 3/16/94

Lab ID: 9403623-03

Client ID: EG3-MPB-5

SIEVE TEST

A. Total weight of sample:

245.94	g
0.1	g
99.96	%

B. Weight retained in No.10 sieve:

C. % passing No.10 sieve:

Sample Description: 301L

Sieve test for weight
retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	0.10	0.04	0.04	99.96
No. 200	221.19	89.94	89.94	10.02

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (P)	PARTICLE DIA. IN MM (P)	
2	20	17	13	14.2	0.0384
5	20	17	13	14.2	0.0230
10	20	15	11	14.5	0.0164
15	20	14	10	14.7	0.0138
25	20	13	8	14.8	0.0100
40	20	12	8	15	0.0084
60	20	12	8	15	0.0068
90	20	11	7	15.2	0.0056
120	20	10	6	15.3	0.0049
1440	20	8	4	15.8	0.0014

% SUSPENDED (%)
11.3
11.3
8.6
8.7
7.8
7.0
7.0
6.1
5.2
3.8

Weight of soil used in hydrometer test (D):

115	g
1	
2.05	
3	
1	
0.01385	

Hydrosopic moisture correction factor (G):

Specific gravity (Assumed):

Dispersing agent correction factor (E):

Meniscus correction factor (F):

Temp./Spec. gravity dependent constant (K):

Formulas:

$$R = H - E \cdot F$$

$$S = K[\text{SQR}(L/T)]$$

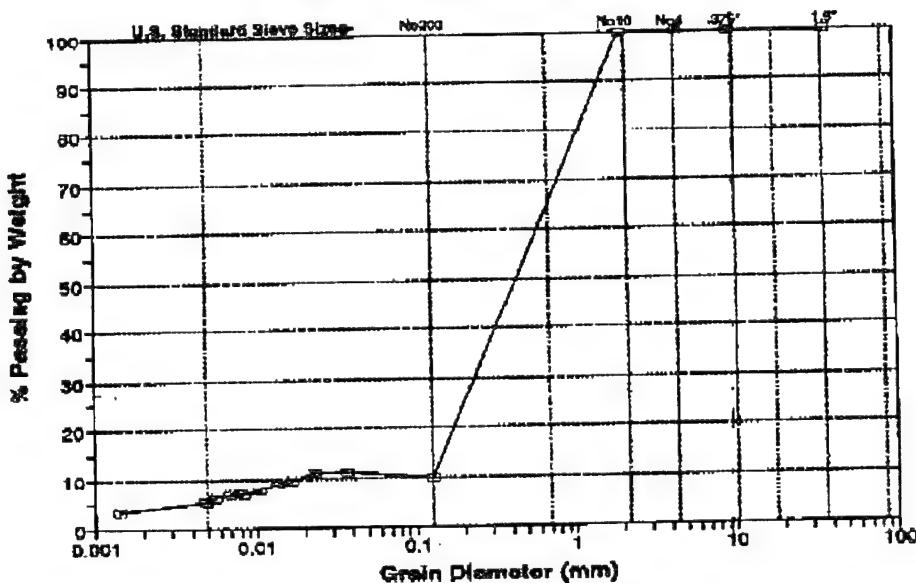
$$P = (R/W)100$$

$$W = (J \times 100)/C$$

$$J = D \times G$$

Method: ASTM D422-63
 Analyzed: 3/18/84
 Lab ID: 9403623-03

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coars	Fine	Coarse	Cobbles
		Sand			Gravel		
Fines							

Graphing Data:

Part. Diam. (mm)	Percent Suspended
0.75	100.00
0.5	100.00
0.45	100.00
0.2	99.96
0.127	10.02
0.0364	11.30
0.0230	11.30
0.0164	9.58
0.0135	8.69
0.0105	7.82
0.0064	6.95
0.0056	6.85
0.0050	6.08
0.0049	5.22
0.0014	3.48

Sample Composition:

- (1) Gravel, passing 3-in. and retained on No. 4 sieve 0.0 %
- (2) Sand, passing No. 4 sieve and retained on No. 200 sieve 80.0 %
- (3) Silt size, 0.074 to 0.005 mm 4.8 %
- (4) Clay size, smaller than 0.005 mm 5.2 %

740303-502

FIGURE B-2
ECONOMY RECORDED

CHILDREN OF CUSTODY RECORD

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

March 29, 1994

PACE Project Number: 740307502

Engineering-Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290

Attn: Mr. Doug Downey

Client Reference: Eglin AFB

PACE Sample Number:

75 0031647

Date Collected:

03/03/94

Date Received:

03/07/94

Client Sample ID:

EG2-VW-3

ParameterUnitsMDLMETHODDATE ANALYZED**SUBCONTRACT ANALYSIS****INDIVIDUAL PARAMETERS**

Grain Size Distribution Curve

SEE ATTACH ASTM D422

03/16/94

Nitrogen, Total Kjeldahl

ND

03/16/94

Total Phosphate

351.3

03/17/94

mg/kg

43

mg/kg

1.1

28

INORGANIC ANALYSIS**INDIVIDUAL PARAMETERS**Alkalinity, Total (As CaCO₃)

MG/KG

42

354

Moisture, Percent

PERCENT

6.0

SM403 (M)

03/16/94

pH

PH UNITS

8.2

D2216

03/09/94

AIR FORCE FAA IRON

SW7380

Soil FAA Metals Date Digested

03/16/94

03/21/94

Iron

MG/KG

200

2560

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

E418.1

Soil TPH Prep Date

03/12/94

Total Petroleum Hydrocarbons

MG/KG

133

2210

03/14/94

ORGANIC ANALYSIS**AIR FORCE AROMATIC VOLATILE ORGANICS**

SW8020

Benzene

MG/KG

5.3

10

03/08/94

Toluene

MG/KG

5.3

21

03/08/94

Ethylbenzene

MG/KG

5.3

24

03/08/94

Xylenes, Total

MG/KG

7.4

72

03/08/94

a,a,a-Trifluorotoluene

PERCENT

94

03/08/94

Instrument ID #

4

03/08/94

Soil Prep Date

3/8/94

03/08/94

Dilution Factor

10000

03/08/94

**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

Mr. Doug Downey
Page 2

March 29, 1994
PACE Project Number: 740307502

Client Reference: Eglin AFB

PACE Sample Number:

75 0031655

Date Collected:

03/04/94

Date Received:

03/07/94

Client Sample ID:

EG2-VMPA-

Parameter

Units MDL METHOD DATE ANALYZED

SUBCONTRACT ANALYSIS

INDIVIDUAL PARAMETERS

Grain Size Distribution Curve
Nitrogen, Total Kjeldahl
Total Phosphate

mg/kg	43	ND	SEE ATTACH	ASTM D422	03/16/94
mg/kg	1.1	29	351.3		03/16/94
			365.1		03/17/94

INORGANIC ANALYSIS

INDIVIDUAL PARAMETERS

Alkalinity, Total (As CaCO₃)
Moisture, Percent
pH

MG/KG	42	ND	SM403 (M)	03/16/94
PERCENT		7.0	D2216	03/09/94
PH UNITS		6.6	SW9045	03/10/94

AIR FORCE FAA IRON

Soil FAA Metals Date Digested
Iron

MG/KG	20	03/16/94	SW7380
		135	03/21/94

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date
Total Petroleum Hydrocarbons

MG/KG	134	03/12/94	E418.1
		3370	03/14/94

ORGANIC ANALYSIS

AIR FORCE AROMATIC VOLATILE ORGANICS

Benzene
Toluene
Ethylbenzene
Xylenes, Total
a,a,a-Trifluorotoluene
Instrument ID #

MG/KG	0.067	0.15	SW8020	03/08/94
MG/KG	0.067	0.19		03/08/94
MG/KG	0.067	0.40		03/08/94
MG/KG	0.094	2.5		03/08/94
PERCENT		79		03/08/94
		4		03/08/94

Soil Prep Date
Dilution Factor

3/8/94	03/08/94
125	03/08/94

PRELIMINARY:
DATA PENDING
FINAL REVIEW

March 29, 1994
 PAGE Project Number: 740307502

Mr. Doug Downey
 Page 3

Client Reference: Eglin AFB

PAGE Sample Number:	75 0031663				
Date Collected:	03/04/94				
Date Received:	03/07/94				
Client Sample ID:	EG2-VMPB-				
<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	<u>2-4'</u>	<u>METHOD</u>	<u>DATE ANALYZED</u>

SUBCONTRACT ANALYSIS

INDIVIDUAL PARAMETERS

Grain Size Distribution Curve		SEE ATTACH	ASTM D422	03/16/94
Nitrogen, Total Kjeldahl	mg/kg	43	ND	351.3
Total Phosphate	mg/kg	1.1	15	365.1

INORGANIC ANALYSIS

INDIVIDUAL PARAMETERS

Alkalinity, Total (As CaCO ₃)	MG/KG	43	128	SM403 (M)	03/16/94
Moisture, Percent	PERCENT		7.6	D2216	03/09/94
pH	PH UNITS		7.8	SW9045	03/10/94

AIR FORCE FAA IRON

Soil FAA Metals Date Digested		03/16/94		
Iron	MG/KG	170	2100	03/21/94

AIR FORCE TOTAL PETROLEUM HYDROCARBONS

Soil TPH Prep Date		03/12/94		
Total Petroleum Hydrocarbons	MG/KG	270	6610	03/14/94

ORGANIC ANALYSIS

AIR FORCE AROMATIC VOLATILE ORGANICS

Benzene	MG/KG	2.7	ND	03/08/94
Toluene	MG/KG	2.7	ND	03/08/94
Ethylbenzene	MG/KG	2.7	9.9	03/08/94
Xylenes, Total	MG/KG	3.8	22	03/08/94
a,a,a-Trifluorotoluene	PERCENT		92	03/08/94
Instrument ID #			4	03/08/94

Soil Prep Date		3/8/94		
Dilution Factor		5000		03/08/94

MAR-29-1994 16:32 FROM PACE INCORPORATED

TO

14042352500 P.17

PRELIMINARY;
DATA PENDING

March 29, FINAL REVIEW
PACE Project Number: 740307502

Mr. Doug Downey
Page 4

Client Reference: Eglin AFB

These data have been reviewed and are approved for release.

Kenneth D. Faust,
Southern California Regional Director

MAR-29-1994 16:32 FROM PACE INCORPORATED

TO

14042352500 P.18

Mr. Doug Downey
Page 5

FOOTNOTES
for pages 1 through 4

March 29, 1994
PACE Project Number 740307502
**PRELIMINARY:
DATA PENDING
FINAL REVIEW**

Client Reference: Eglin AFB

MDL Method Detection Limit
ND Not detected at or above the MDL.

SEQUOIA ANALYTICAL LABORATORY**Particle Size Distribution by Sieve and Hydrometer**

Method: ASTM D422-63

Analyzed: 8/18/94

Lab ID: 9403628-01

Client ID: EG2-VW-31

SIEVE TEST

A. Total weight of sample:

212.91	g
2.36	g
98.90	%

B. Weight retained in No.10 sieve:

C. % passing No.10 sieve:

Sample Description: SOIL

Sieve test for weight
retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.26	0.12	0.12	99.88
No. 10	2.06	0.98	1.10	88.89
No. 20U	193.33	99.80	91.31	8.06

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (T)	PARTICLE SIZE IN MM (L)	WEIGHT IN MM (W)
2	20	15	11	14.5	0.0368
5	20	14	10	14.7	0.0234
10	20	13	9	14.8	0.0168
15	20	13	9	14.6	0.0198
25	20	12	8	15	0.0108
40	20	12	8	15	0.0084
60	20	12	8	15	0.0068
80	20	12	8	15	0.0068
120	20	11	7	15.2	0.0049
1440	30	10	8	15.3	0.0014

% SUSPENDED (F)
9.5
9.6
7.7
7.7
6.0
6.9
6.9
6.9
6.0
6.0
5.2

Weight of soil used in hydrometer test (D):

115	g
1	
2.65	
3	
1	
0.01365	

Hydroscopic moisture correction factor (G):

Specific gravity (Assumed):

Dispersion agent correction factor (P):

Meniscus correction factor (F):

Temp./Spec. gravity dependent constant (Q):

Formulas:

$$R = H - E - F$$

$$S = K[\text{SQR}(L/T)]$$

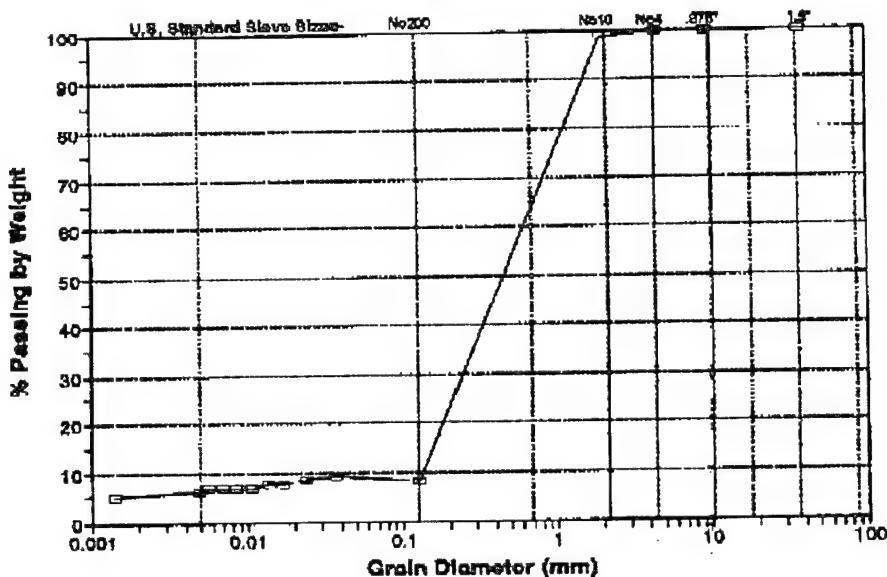
$$P = (R/W)100$$

$$W = (J \times 100)/C$$

$$J = D \times Q$$

Method: ASTM D422-63
 Analyzed: 3/16/94
 Lab ID: 9408026-01

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium	Coars	Fines	Coarse	Cobbles
Finer		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	99.88
2	99.90
0.127	8.09
0.0399	9.46
0.0234	6.60
0.0166	7.74
0.0138	7.74
0.0106	6.66
0.0084	6.66
0.0068	6.66
0.0056	6.66
0.0049	6.02
0.0014	5.16

Sample Composition:

- (1) Gravel, passing 3-in. and retained on No. 4 sieve 0.1 %
- (2) Sand, passing No. 4 sieve and retained on No. 200 sieve 81.6 %
- (3) Silt size, 0.074 to 0.005 mm 2.1 %
- (4) Clay size, smaller than 0.005 mm 6.0 %

SEQUOIA ANALYTICAL LABORATORY**Particle Size Distribution by Sieve and Hydrometer**

Method: ASTM D422-63

Analyzed: 3/16/94

Lab ID: 9403628-02

Client ID: EG2-VMPA-39"

SIEVE TEST

A. Total weight of sample:

280.56	g
0.09	g
99.96	%

B. Weight retained in No.10 sieve:

Sample Description: SOIL

C. % passing No.10 sieve:

Sieve test for weight
retained in a No.10 sieve.

SIEVE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE % RETAINED	CUMULATIVE % PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	0.09	0.04	0.04	99.96
No. 200	221.56	99.96	99.96	7.48

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (T)	(1)	PARTICLE
2	20	14	10	14.7	0.0370
5	20	9	5	15.5	0.0240
10	20	9	5	15.6	0.0170
15	20	9	5	15.5	0.0189
25	20	9	5	15.6	0.0107
40	20	9	5	15.5	0.0095
50	20	9	4	15.6	0.0070
90	20	9	4	15.6	0.0087
120	20	5	4	15.6	0.0049
1440	20	7	3	15.6	0.0014

% SUSPENDED (%)
8.7
4.3
4.3
4.3
4.3
3.5
3.5
3.5
2.8

Weight of soil used in hydrometer test (D):

115	g
1	
2.65	
3	
1	
0.01963	

Hydrometric moisture correction factor (G):

Formulas:

Specific gravity (Assumed):

$$R = H - E - F$$

Dispensing agent correction factor (E):

$$S = K \sqrt{Q} (L/T)$$

Merkous correction factor (F):

$$P = (R/W)100$$

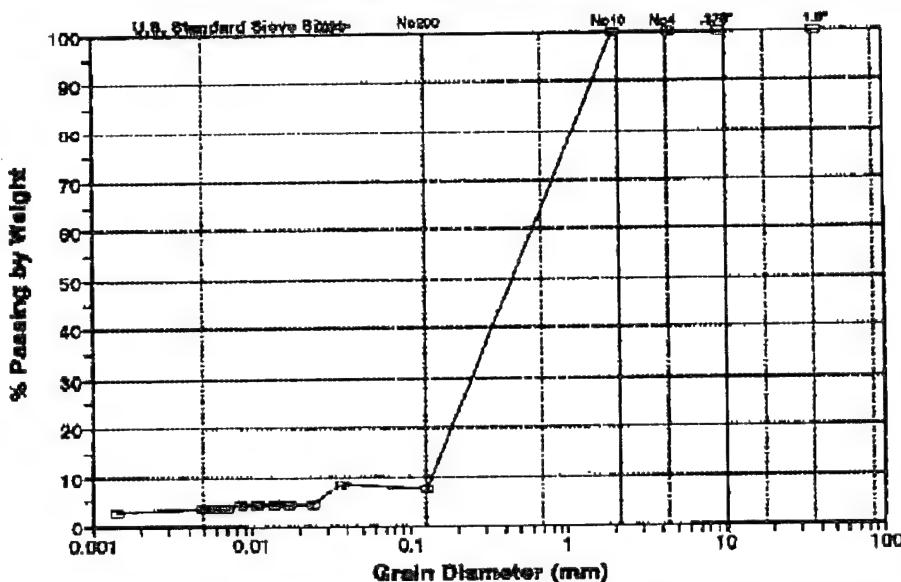
Temp./Spec. gravity dependent constant (K):

$$W = (\rho \times 100)/G$$

$$J = D \times G$$

Method: ASTM D422-63
 Analyzed: 3/16/94
 Lab ID: 9403626-02

Graph of Acquired Data



Clay Sizes	Silt Sizes	Fine	Medium Coarse	Fine	Coarse	Cobbles
Fines		Sand		Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
37.5	100.00
9.5	100.00
4.5	100.00
2	89.98
0.127	7.48
0.0370	6.69
0.0240	4.35
0.0170	4.35
0.0139	4.35
0.0107	4.35
0.0065	4.35
0.0070	8.48
0.0057	8.48
0.0048	3.48
0.0014	2.61

Sample Composition:

- | | |
|--|--------|
| (1) Gravel, passing 3-in. and
retained on No. 4 sieve | 0.0 % |
| (2) Sand, passing No. 4 sieve and
retained on No. 200 sieve | 92.5 % |
| (3) Silt size, 0.074 to 0.005 mm | 4.0 % |
| (4) Clay sizes, smaller than 0.005 mm | 3.5 % |

SEQUOIA ANALYTICAL LABORATORY**Particle Size Distribution by Sieve and Hydrometer**

Method: ASTM D422-63

Analyzed: 3/16/94

Lab ID: 9403628-03

Client ID: BG2-VMPB-2-4

SIEVE TEST

- A. Total weight of sample:
B. Weight retained in No.10 sieve:
C. % passing No.10 sieve:

225.88	g
1.19	g
99.47	%

Sample Description: 90R.

Sieve test for weight
retained in a No.10 sieve.

AVERAGE SIZE	WEIGHT RETAINED(g)	% RETAINED	CUMULATIVE	CUMULATIVE
			% RETAINED	% PASSING
1 1/2 in	0.00	0.00	0.00	100.00
3/8 in	0.00	0.00	0.00	100.00
No. 4	0.00	0.00	0.00	100.00
No. 10	1.19	0.53	0.53	99.47
No. 200	207.01	91.85	92.17	7.83

HYDROMETER TEST

ELAPSED TIME (min)	TEMP. (deg C)	HYDROMETER READING (H)	CORRECTED READING (RV)	(L)	PARTICLE DIA. IN MM (mm)
2	20	14	10	14.7	0.0370
8	20	14	10	14.7	0.0234
10	20	13	8	14.8	0.0166
15	20	12	8	15	0.0137
25	20	12	8	15	0.0109
40	20	11	7	15.3	0.0084
60	20	11	7	15.2	0.0069
90	20	11	7	15.2	0.0059
120	20	11	7	15.2	0.0049
1440	20	10	6	15.3	0.0014

% SUSPENDED (P)
8.6
8.6
7.8
6.9
6.9
6.1
6.1
6.1
6.1
5.2

Weight of soil used in hydrometer test (D):

115	g
1	
2.65	
9	
1	
0.01365	

Formulas:

$$R = H - E - F$$

$$S = K(\sqrt{RT/L})$$

$$P = (R/W)100$$

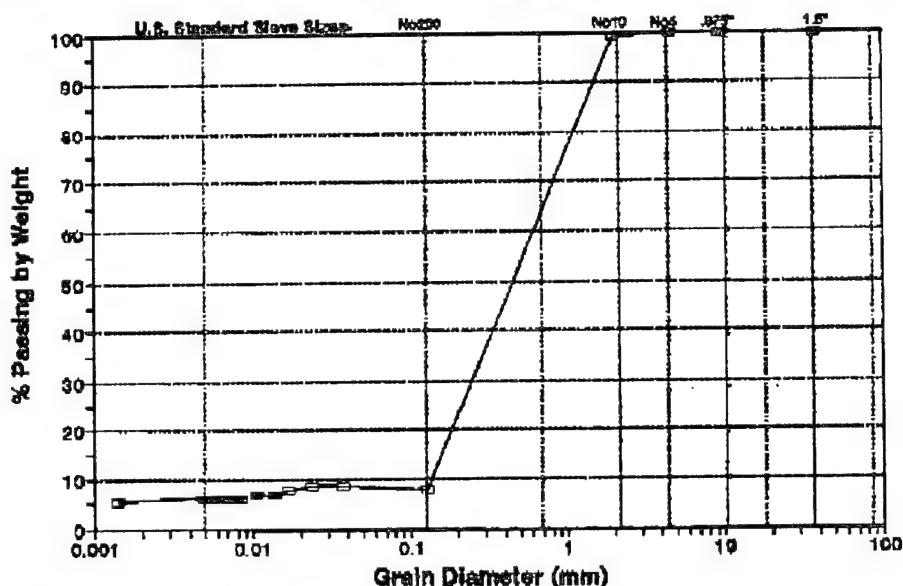
$$W = (J \times 100)/D$$

$$J = D \times G$$

Hydrometer moisture correction factor (E):
Specific gravity (Assumed):
Dispensing agent correction factor (F):
Meniscus correction factor (G):
Temp./Spec. gravity dependant constant (K):

Method: ASTM D422-63
 Analyzed: 3/16/94
 Lab ID: 9403028-03

Graph of Acquired Data



Clay Sizes	SIE Sizes	Fine	Medium	Coarse	Fine	Coarse	Cobbles
Fines		Sand			Gravel		

Graphing Data:

Part. Diam. (mm)	Percent Suspended
07.6	100.00
9.5	100.00
4.5	100.00
2	99.47
0.127	7.83
0.0370	8.86
0.0234	8.85
0.0168	7.78
0.0137	8.92
0.0106	6.92
0.0084	6.08
0.0069	6.05
0.0056	6.05
0.0049	5.05
0.0014	5.19

Sample Composition:

- (1) Gravel, passing 3-in. and retained on No. 4 sieve 0.0 %
- (2) Sand, passing No. 4 sieve and retained on No. 200 sieve 92.2 %
- (3) Silt size, 0.074 to 0.005 mm 1.6 %
- (4) Clay size, smaller than 0.005 mm 8.1 %

730307.502

FIGURE B.2
CHAINS OF DECISION BY RECORDED

TOTAL P.25

APPENDIX D

**PERMEABILITY TEST AND
BIODEGRADATION RATE CALCULATIONS
FOR HURLBURT FTA**

HURLBURT

EGLIN AFB / EG3 / EGLIN-FTA
Steady-state Equation – Air Injection

$$k = \frac{Q \mu \ln (R_w / R_i)}{H \pi P_{atm} [1 - (P_w / P_{atm})^2]}$$

Where:

Q = Volumetric flow rate of vent well

$$13.0 \text{ scfm} \times (30.48 \text{ cm/ft})^3 \times (1 \text{ min}/60 \text{ s}) = 6.14E+03 \text{ cm}^3/\text{s}$$

$$\mu = \text{Viscosity of Air @ } 18^\circ \text{ C} = 1.80E-04 \text{ g/cm s}$$

Patm = Ambient pressure @ 200 feet of elevation

$$403 \text{ inches H}_2\text{O} \times (3.61E-2 \text{ psia/in. H}_2\text{O}) = 14.548 \text{ psia}$$

$$14.548 \text{ psia} \times (6.89476E4 \text{ g/cm s}^2)/\text{psia} = 1.00E+06 \text{ g/cm s}^2$$

Rw = Radius of Vent Well

$$2 \text{ inches} \times 2.54 \text{ cm/in} = 5.08 \text{ cm}$$

H = Depth of Screen (length of screened interval)

$$5 \text{ feet} \times 30.48 \text{ cm/ft} = 152 \text{ cm}$$

Ri = Maximum Radius of Venting Influence

$$75 \text{ feet} \times 30.48 \text{ cm/ft} = 2286 \text{ cm}$$

Pw = Absolute Pressure at Vent Well

$$40 \text{ inches H}_2\text{O} \times (3.61E-2 \text{ psia/in. H}_2\text{O}) = 1.444 \text{ psia}$$

$$1.444 \text{ psia} + \boxed{ } = 15.992 \text{ psia}$$

$$15.992 \text{ psia} \times (6.89476E4 \text{ g/cm s}^2)/\text{psia} = 1.10E+06 \text{ g/cm s}^2$$

$$k = 6.742E-08 \text{ cm}^2$$

$$6.740E-08 \text{ cm}^2 \times (1 \text{ m}/100 \text{ cm})^2 = 6.700E-12 \text{ m}^2$$

$$6.700E-12 \text{ m}^2 \times 1 \text{ darcy}/(9.870E-13 \text{ m}^2) = 6.79 \text{ darcys}$$

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points

$r = 40$ (ft)

② Enter measured times and gauge vacuums

	(min)	(in H ₂ O)
1	0	0
2	0.35	0.35
3	-0.7	-0.7
4	1.1	1.1
5	1.35	1.35
6	-1.6	-1.6
7	1.75	1.75
8	-1.9	-1.9
9	2.05	2.05
10	2.15	2.15

③ Enter (optional):

a) flowrate

...13 (SCFM)

b) screened interval thickness

5 (ft)

clear

$r = 40$ (ft)

	(min)	(in H ₂ O)
1	0	0
2	0.4	0.4
3	0.8	0.8
4	1.2	1.2
5	1.45	1.45
6	-1.7	-1.7
7	1.85	1.85
8	2.0	2.0
9	2.15	2.15
10	2.25	2.25

$r = 20$ (ft)

	(min)	(in H ₂ O)
1	-1.1	-1.1
2	2.6	2.6
3	3.5	3.5
4	4.1	4.1
5	4.5	4.5
6	-4.9	-4.9
7	5.1	5.1
8	5.3	5.3
9	5.5	5.5
10	5.7	5.7

-->Calculate<--

k= 26.5976 darcy (A)
k= 56.5948 darcy (B)

k= 26.2783 darcy (A)
k= 60.5987 darcy (B)

k= 14.9901 darcy (A)
k= 46.6908 darcy (B)



← Return →

Explanation & Statistics

AP8

Q C B n b
6 - 10 . u u

Air Permeability Test - Data Analysis (cont.)

Enter radial

 $\rightarrow r = 40$ (ft)

- ① Enter radial distances of monitoring points

(min)	(in H ₂ O)
12	2.3 
14	2.45 
16	2.5 
18	2.6 
20	2.65 
23	2.7 
26	2.75 
29	2.8 
32	2.85 
35	2.85 

- ② Enter measured times and gauge vacuums

 $\rightarrow r = 40$ (ft)

(min)	(in H ₂ O)
12	2.4 
14	2.5 
16	2.6 
18	2.7 
20	2.75 
23	2.8 
26	2.75 
29	2.9 
32	2.95 
35	2.95 

 $\rightarrow r = 20$ (ft)

(min)	(in H ₂ O)
12	6.0 
14	6.1 
16	6.3 
18	6.4 
20	6.5 
23	6.6 
26	6.7 
29	6.7 
32	6.8 
35	6.9 

- ③ Enter (optional):

a) flowrate

13 (SCFM)

b) screened interval thickness

5 (ft)

clear

clear

clear

-->Calculate<--

k= 26.5976 darcy (A)

k= 56.5948 darcy (B)

k= 26.2783 darcy (A)

k= 60.5987 darcy (B)

k= 14.9901 darcy (A)

k= 46.6908 darcy (B)



Return



Explanation & Statistics

AP8

Air Permeability Test - Data Analysis (cont.)

On the previous Card (AP8), the data you input were fit to the approximate expression given on Card AP6. It was analyzed using both methods described on card AP7, if you input values for the extraction well flowrate (Q) and the stratum thickness (m). Below each column of data, the two calculated permeability values are denoted by:

darcy(A) - refers to calculation method 1 (see Card AP7)

darcy(B) - refers to calculation method 2 (see Card AP7)

During the regression analyses, the data expressed as pairs of points ($\ln(t)$, P') are fit to a line. The "correlation coefficient", r , is a measure of how well the data conform to the theoretical curve. As $r \rightarrow 1$, the data points all fall on the theoretical curve. At the right are given the correlation coefficient values for the three data sets. For more info on the meaning of r , consult any introductory Statistics book.

Correlation Coef.

(r)

data set #1 0.987386

data set #2 0.986659

data set #3 0.980926



Return

AP9

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points

$r = \boxed{10}$ (ft)

$r = \boxed{10}$ (ft)

$r = \boxed{20}$ (ft)

② Enter measured times and gauge vacuums

③ Enter (optional):

a) flowrate

(SCFM)

b) screened interval thickness

(ft)

(min)	(in H ₂ O)
1	4.0
2	6.1
3	7.25
4	7.9
5	8.4
6	8.75
7	9.0
8	9.2
9	9.4
10	9.9

(min)	(in H ₂ O)
1	5.0
2	7.0
3	8.0
4	8.5
5	9.0
6	9.25
7	9.6
8	9.8
9	10.0
10	10.1

(min)	(in H ₂ O)
1	1.1
2	2.2
3	2.9
4	3.3
5	3.6
6	3.9
7	4.1
8	4.3
9	4.4
10	4.55

k= darcy (A)
k= darcy (B)

k= darcy (A)
k= darcy (B)

k= darcy (A)
k= darcy (B)

-->Calculate<--



Return



Explanation & Statistics

AP8

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points

$r = \boxed{10}$ (ft)

MPA-S

(min) (in H₂O)

14	10.0	▲
16	10.2	▲
18	10.3	▲
20	10.4	▲
23	10.5	▲
26	10.7	▲
29	10.75	▲
32	10.8	▲
35	10.9	▲
38	10.95	▼

② Enter measured times and gauge vacuums

$r = \boxed{10}$ (ft)

MPA-D

(min) (in H₂O)

12	10.4	▲
14	10.5	▲
16	10.75	▲
18	10.9	▲
20	11.0	▲
23	11.0	▲
26	11.1	▲
29	11.1	▲
32	11.25	▲
35	11.4	▼

③ Enter (optional):

a) flowrate

(SCFM)

clear

b) screened interval thickness

(ft)

clear

clear

-->Calculate<--

k= darcy (A)
k= darcy (B)

k= darcy (A)
k= darcy (B)

k= darcy (A)
k= darcy (B)



Return



Explanation & Statistics

AP8

Air Permeability Test - Data Analysis (cont.)

On the previous Card (AP8), the data you input were fit to the approximate expression given on Card AP6. It was analyzed using both methods described on card AP7, if you input values for the extraction well flowrate (Q) and the stratum thickness (m). Below each column of data, the two calculated permeability values are denoted by:

darcy(A) - refers to calculation method 1 (see Card AP7)

darcy(B) - refers to calculation method 2 (see Card AP7)

During the regression analyses, the data expressed as pairs of points ($\ln(t)$, P') are fit to a line. The "correlation coefficient", r , is a measure of how well the data conform to the theoretical curve. As $r \rightarrow 1$, the data points all fall on the theoretical curve. At the right are given the correlation coefficient values for the three data sets. For more info on the meaning of r , consult any introductory Statistics book.

Correlation Coef.

(r)

data set #1 0.968318

data set #2 0.972764

data set #3 0.981263



Return

AP9

EGLIN AFB (Hurlburt) – INITIAL – MPA-D(5)
 Biodegradation Rate Calculations enter data calculated data

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where:

K_b = fuel biodegradation rate

K_o = O₂ utilization rate (%/min.)

A = volume of air/kg soil

D_o = O₂ density 1340 mg/L

C = Carbon/O₂ ratio for hexane mineralization = 1/3.5

Test Results: MPA-D(5) K_o = max. observed rate 0.0029 %/min.
 w = moisture content 5.8 %

Assume: Soil properties for Mixed grained sand, loose Specify from
 Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn,
 John Wiley Press, 1974)

Porosity:	$n =$	0.40
Unit weight (dry):	$\gamma_d =$	1.59
Void ratio:	$e = n/1 - n =$	0.67
Specific gravity:	$G =$	2.65

Calculate A = Air filled volume (V_a)/unit wt.

Solving for 1 liter of soil

a) $V_v = n * 1 L$
 $V_v =$ 0.4 liters V_v = void volume

b) $S_r = Gw/e$
 $S_r =$ 0.23 S_r = degree of saturation

c) $V_w = S_r \times V_v$
 $V_w =$ 0.09 liters V_w = volume of water

d) $V_a = V_v - V_{vw}$
 $V_a =$ 0.31 liters V_w = volume of water

e) Bulk density = $\gamma_d + (V_w \times \gamma_w) =$ 1.7 kg/l soil

f) $A = V_a / \text{Bulk density} =$ 0.182 l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times 525,600 \text{ min/yr} =$ 1062 mg TPH/year

EGLIN AFB (Hurlburt) – INITIAL – MPB-D(5)

Biodegradation Rate Calculations

enter data

calculated data

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where: K_b = fuel biodegradation rate K_o = O₂ utilization rate (%/min.)

A = volume of air/kg soil

 D_o = O₂ density 1340 mg/LC = Carbon/O₂ ratio for hexane mineralization = 1/3.5Test Results: MPB-D(5) K_o = max. observed rate 0.0026 %/min.
w = moisture content 7.1 %Assume: Soil properties for Mixed grained sand, loose Specify from
Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn,
John Wiley Press, 1974)Porosity: $n =$ 0.40Unit weight (dry): $\gamma_d =$ 1.59Void ratio: $e = n/1 - n =$ 0.67Specific gravity: $G =$ 2.65Calculate A = Air filled volume (V_a)/unit wt.

Solving for 1 liter of soil

a) $V_v = n * 1 L$

$V_v =$ 0.4 liters V_v = void volume

b) $S_r = Gw/e$

$S_r =$ 0.28 S_r = degree of saturation

c) $V_w = S_r \times V_v$

$V_w =$ 0.11 liters V_w = volume of water

d) $V_a = V_v - V_w$

$V_a =$ 0.29 liters V_w = volume of water

e) Bulk density = $\gamma_d + (V_w \times \gamma_w) =$ 1.7 kg/l soil

f) $A = V_a / \text{Bulk density} =$ 0.171 l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times 525,600 \text{ min/yr} =$ 895 mg TPH/year

EGLIN AFB (Hurlburt) – INITIAL – MPC-S(3)
 Biodegradation Rate Calculations enter data calculated data

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where:

K_b = fuel biodegradation rate

K_o = O₂ utilization rate (%/min.)

A = volume of air/kg soil

D_o = O₂ density 1340 mg/L

C = Carbon/O₂ ratio for hexane mineralization = 1/3.5

Test Results: MPC-S(3) K_o = max. observed rate 0.0034 %/min.
 w = moisture content 5.8 %

Assume: Soil properties for Mixed grained sand, loose Specify from
 Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn,
 John Wiley Press, 1974)

Porosity:	$n =$	0.40
Unit weight (dry):	$\gamma_d =$	1.59
Void ratio:	$e = n/1 - n =$	0.67
Specific gravity:	G =	2.65

Calculate A = Air filled volume (V_a)/unit wt.

Solving for 1 liter of soil

a) $V_v = n * 1 L$

$V_v =$ 0.4 liters V_v = void volume

b) $S_r = Gw/e$

$S_r =$ 0.23 S_r = degree of saturation

c) $V_w = S_r \times V_v$

$V_w =$ 0.09 liters V_w = volume of water

d) $V_a = V_v - V_{ww}$

$V_a =$ 0.31 liters V_w = volume of water

e) Bulk density = $\gamma_d + (V_w \times \gamma_w) =$ 1.7 kg/l soil

f) $A = V_a / \text{Bulk density} =$ 0.182 l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times 525,600 \text{ min/yr} =$ 1245 mg TPH/year

APPENDIX E

**PERMEABILITY TEST AND
BIODEGRADATION RATE CALCULATIONS
FOR EGLIN FTA**

EGLIN
EGLIN AFB / HURLBURT FTA
Steady-state Equation – Air Injection

Enter data

Calculated data

$$k = \frac{Q \mu \ln (R_w / R_i)}{H \pi P_{atm} [1 - (P_w / P_{atm})^2]}$$

Where:

Q = Volumetric flow rate of vent well

92.0	scfm x $(30.48 \text{ cm}/\text{ft})^3$ x $(1 \text{ min}/60 \text{ s})$ =	4.34E+04	cm $^3/\text{s}$
------	--	----------	------------------

μ = Viscosity of Air @ 18°C =	1.80E-04	g/cm s
--	----------	--------

P_{atm} = Ambient pressure @ 200 feet of elevation

403	inches H ₂ O x $(3.61 \times 10^{-2} \text{ psia/in. H}_2\text{O})$ =	14.548	psia
-----	--	--------	------

14.548	psia x $(6.89476 \times 10^4 \text{ g/cm s}^2)$ /psia =	1.00E+06	g/cm s 2
--------	---	----------	-------------

R_w = Radius of Vent Well

2	inches x 2.54 cm/in =	5.08	cm
---	-----------------------	------	----

H = Depth of Screen (length of screened interval)

35	feet x 30.48 cm/ft =	1067	cm
----	----------------------	------	----

R_i = Maximum Radius of Venting Influence

65	feet x 30.48 cm/ft =	1981	cm
----	----------------------	------	----

P_w = Absolute Pressure at Vent Well

4	inches H ₂ O x $(3.61 \times 10^{-2} \text{ psia/in. H}_2\text{O})$ =	0.144	psia
---	--	-------	------

0.144	psia +	14.548	psia =	14.693	psia
-------	--------	--------	--------	--------	------

14.693	psia x $(6.89476 \times 10^4 \text{ g/cm s}^2)$ /psia =	1.01E+06	g/cm s 2
--------	---	----------	-------------

$$k = \frac{6.953 \times 10^{-7}}{6.950 \times 10^{-11}} \text{ darcys}$$

6.953E-07	cm 2 x $(1 \text{ m}/100 \text{ cm})^2$ =	6.953E-07	cm 2
-----------	--	-----------	---------

6.950E-11	m 2 x $1 \text{ darcy}/(9.870 \times 10^{-13} \text{ m}^2)$ =	70.42	darcys
-----------	--	-------	--------

Air Permeability Test - Data Analysis (cont.)

Enter radial

→ r= (ft)

- ① distances of monitoring points

(min) (in H₂O)

1	0.5	▲
2	.8	▼
3	.95	▲
4	1.05	▼
5	1.1	▲
6	1.15	▼
7	1.17	▲
8	1.2	▼
9	1.22	▲
10	1.25	▼

Enter measured →

r= (ft)

- ② times and gauge vacuums

(min) (in H₂O)

1	.85	▲
2	1.2	▼
3	1.25	▲
4	1.4	▼
5	1.5	▲
6	1.5	▼
7	1.55	▲
8	1.55	▼
9	1.6	▲
10	1.65	▼

r= (ft)(min) (in H₂O)

1	1.1	▲
2	1.45	▼
3	1.6	▲
4	1.65	▼
5	1.75	▲
6	1.8	▼
7	1.8	▲
8	1.85	▼
9	1.90	▲
10	1.90	▼

- ③ Enter (optional):

a) flowrate

 (SCFM)

b) screened interval thickness

 (ft)

clear

-->Calculate<--

k= darcy (A)
k= darcy (B)k= darcy (A)
k= darcy (B)k= darcy (A)
k= darcy (B)

Return



Explanation & Statistics

AP8

Q ~ $B(LB \cdot 6^{-13} \cdot g^4)$

Air Permeability Test - Data Analysis (cont.)

Enter radial

 $\rightarrow r = 20$ (ft)

- ① Enter radial distances of monitoring points

(min) (in H₂O)

12	1.32	↑
14	1.42	↓
16	1.45	
18.5	1.46	
20.33	1.5	
22.5	1.5	
26	1.55	
29	1.6	
32	1.6	↑
35	1.7	↓

Enter measured

 \rightarrow

- ② Enter measured times and gauge vacuums

(min) (in H₂O) $r = 10$ (ft)(min) (in H₂O) $r = 10$ (ft)(min) (in H₂O)

12	1.7	↑
14	1.8	↓
16	1.8	
19	1.8	
20	1.85	
23	1.85	
26	1.85	
29	1.9	
32	1.95	↑
35	1.9	↓

12	2.0	↑
14	2.05	↓
16	2.05	
19	2.05	
20	2.05	
23	2.1	
26	2.15	
29	2.15	
32	2.20	↑
35	2.20	↓

- ③ Enter (optional):

a) flowrate

92 (SCFM)

b) screened interval

thickness

35 (ft)

clear

--->Calculate<---

k= 77.4965 darcy (A)

k= 97.3548 darcy (B)

clear

k= 82.8652 darcy (A)

k= 109.285 darcy (B)

clear

k= 84.0329 darcy (A)

k= 305.225 darcy (B)



Return



Explanation & Statistics

AP8

Air Permeability Test - Data Analysis (cont.)

On the previous Card (AP8), the data you input were fit to the approximate expression given on Card AP6. It was analyzed using both methods described on card AP7, if you input values for the extraction well flowrate (Q) and the stratum thickness (m). Below each column of data, the two calculated permeability values are denoted by:

darcy(A) - refers to calculation method 1 (see Card AP7)

darcy(B) - refers to calculation method 2 (see Card AP7)

During the regression analyses, the data expressed as pairs of points ($\ln(t)$, P') are fit to a line. The "correlation coefficient", r , is a measure of how well the data conform to the theoretical curve. As $r \rightarrow 1$, the data points all fall on the theoretical curve. At the right are given the correlation coefficient values for the three data sets. For more info on the meaning of r , consult any introductory Statistics book.

Correlation Coef.

(r)

data set #1 0.994199

data set #2 0.985485

data set #3 0.984607



Return

AP9

Air Permeability Test - Data Analysis (cont.)

Enter radial

→ $r = 20$ (ft)

- ① Enter radial distances of monitoring points

(min) (in H₂O)

1	.55	▲
2	.85	■
3	.95	●
4	1.05	
5	1.1	
6	1.15	
7	1.15	
8	1.2	
9	1.25	
10	1.25	▼

- ② Enter measured times and gauge vacuums

 $r = 20$ (ft)(min) (in H₂O)

1	0.05	▲
2	0.05	■
3	0.05	●
4	0.05	
5	0.05	
6	0.05	
7	0.05	
8	0.05	
9	0.05	
10	0.05	▼

- ③ Enter (optional):

a) flowrate

92 (SCFM)

clear

b) screened interval thickness

35 (ft)

clear

clear

-->Calculate<--

k= 89.3732 darcy (A)
k= 169.313 darcy (B)k= 6207899 darcy (A)
k= INF darcy (B)k= [] darcy (A)
k= [] darcy (B)

Return



Explanation & Statistics

AP8

Q_c(ft³)
6-13-A⁴

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points

$\rightarrow r = \boxed{20}$ (ft)

$r = \boxed{20}$ (ft)

$r = \boxed{\quad}$ (ft)

② Enter measured times and gauge vacuums

(min)	(in H ₂ O)
12	1.3 
14	1.4 
16	1.4 
19	1.45 
20	1.45 
23	1.45 
26	1.50 
29	1.55 
32	1.55 
35	1.5 

(min)	(in H ₂ O)
12	0.05 
14	0.05 
16	0.05 
19	0.05 
20	0.05 
23	0.05 
26	0.05 
29	0.05 
32	0.05 
35	0.05 

(min)	(in H ₂ O)
	
	

③ Enter (optional):

a) flowrate

(SCFM)

b) screened interval thickness

(ft)

-->Calculate<--

k= darcy (A)
k= darcy (B)

k= darcy (A)
k= darcy (B)

k= darcy (A)
k= darcy (B)



Air Permeability Test - Data Analysis (cont.)

On the previous Card (AP8), the data you input were fit to the approximate expression given on Card AP6. It was analyzed using both methods described on card AP7, if you input values for the extraction well flowrate (Q) and the stratum thickness (m). Below each column of data, the two calculated permeability values are denoted by:

darcy(A) - refers to calculation method 1 (see Card AP7)

darcy(B) - refers to calculation method 2 (see Card AP7)

During the regression analyses, the data expressed as pairs of points ($\ln(t)$, P') are fit to a line. The "correlation coefficient", r , is a measure of how well the data conform to the theoretical curve. As $r \rightarrow 1$, the data points all fall on the theoretical curve. At the right are given the correlation coefficient values for the three data sets. For more info on the meaning of r , consult any introductory Statistics book.

Correlation Coef.

(r)

data set #1 0.989789

data set #2 -NAN(00)

data set #3 No Data



Return

AP9

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points

$r = 40$ (ft)

MPC-S

(min) (in H₂O)

1	.12	▲
2	.32	▼
3	.45	▲
4	.54	▼
5	.59	▲
6	.62	▼
7	.65	▲
8	.67	▼
9	.69	▲
10	.72	▼

② Enter measured times and gauge vacuums

$r = 40$ (ft)

MPC-M

(min) (in H₂O)

1	.11	▲
2	.30	▼
3	.42	▲
4	.49	▼
5	.54	▲
6	.57	▼
7	.61	▲
8	.63	▼
9	.64	▲
10	.68	▼

③ Enter (optional):

a) flowrate

92 (SCFM)

b) screened interval thickness

35 (ft)

clear

-->Calculate<--

k= 86.7045 darcy (A)
k= 93.9563 darcy (B)

$r = 40$ (ft)

MPC-D

(min) (in H₂O)

1	.12	▲
2	.32	▼
3	.44	▲
4	.52	▼
5	.57	▲
6	.59	▼
7	.62	▲
8	.64	▼
9	.66	▲
10	.70	▼

clear

k= 85.5060 darcy (A)
k= 81.1949 darcy (B)

k= 82.9221 darcy (A)
k= 81.2132 darcy (B)



Return



Explanation & Statistics

AP8

Air Permeability Test - Data Analysis (cont.)

① Enter radial distances of monitoring points

$\rightarrow r = \boxed{40}$ (ft)

(min) (in H₂O)

12	.77	▲
14	.86	▼
16	.90	▼
18.5	.92	▼
20.33	.92	▼
22.5	.94	▼
26	1.0	▼
29	1.02	▼
32	1.1	▼
35	1.2	▼

② Enter measured times and gauge vacuums

$\rightarrow r = \boxed{40}$ (ft)

(min) (in H₂O)

12	.74	▲
14	.83	▼
16	.87	▼
18.5	.89	▼
20.33	.90	▼
22.5	.91	▼
26	.97	▼
29	1.05	▼
32	1.1	▼
35	1.15	▼

③ Enter (optional):

a) flowrate

(SCFM)

b) screened interval thickness

(ft)

-->Calculate<--

k= darcy (A)
k= darcy (B)

k= darcy (A)
k= darcy (B)

k= darcy (A)
k= darcy (B)



Air Permeability Test - Data Analysis (cont.)

On the previous Card (AP8), the data you input were fit to the approximate expression given on Card AP6. It was analyzed using both methods described on card AP7, if you input values for the extraction well flowrate (Q) and the stratum thickness (m). Below each column of data, the two calculated permeability values are denoted by:

darcy(A) - refers to calculation method 1 (see Card AP7)

darcy(B) - refers to calculation method 2 (see Card AP7)

During the regression analyses, the data expressed as pairs of points ($\ln(t)$, P') are fit to a line. The "correlation coefficient", r , is a measure of how well the data conform to the theoretical curve. As $r \rightarrow 1$, the data points all fall on the theoretical curve. At the right are given the correlation coefficient values for the three data sets. For more info on the meaning of r , consult any introductory Statistics book.

Correlation Coef.

(r)

data set #1 0.992033

data set #2 0.991906

data set #3 0.977866



Return

AP9

EGLIN AFB (EG2) - INITIAL - MPA-S
Biodegradation Rate Calculations

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where:

K_b = fuel biodegradation rate

K_o = O₂ utilization rate (%/min.)

A = volume of air/kg soil

D_o = O₂ density 1340 mg/L

C = Carbon/O₂ ratio for hexane mineralization = 1/3.5

Test Results: MPA-S K_o = max. observed rate 0.0042 %/min.
 w = moisture content 6.8 %

Assume: Soil properties for Mixed grained sand, loose Specify from
Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn,
John Wiley Press, 1974)

Porosity: $n = 0.40$

Unit weight (dry): $\gamma_d = 1.59$

Void ratio: $e = n/1 - n = 0.67$

Specific gravity: $G = 2.65$

Calculate A = Air filled volume (V_a)/unit wt.

Solving for 1 liter of soil

a) $V_v = n * 1 L$
 $V_v = 0.4$ liters V_v = void volume

b) $S_r = Gw/e$
 $S_r = 0.27$ S_r = degree of saturation

c) $V_w = S_r \times V_v$
 $V_w = 0.11$ liters V_w = volume of water

d) $V_a = V_v - V_w$
 $V_a = 0.29$ liters V_w = volume of water

e) Bulk density = $\gamma_d + (V_w \times \gamma_w) = 1.7$ kg/l soil

f) $A = V_a / \text{Bulk density} = 0.171$ l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times 525,600 \text{ min/yr} = 1445$ mg TPH/year

EGLIN AFB (EG2) - INITIAL - MPB-M

Biodegradation Rate Calculations

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where: K_b = fuel biodegradation rate K_o = O₂ utilization rate (%/min.)

A = volume of air/kg soil

 D_o = O₂ density 1340 mg/LC = Carbon/O₂ ratio for hexane mineralization = 1/3.5Test Results: MPB-M K_o = max. observed rate 0.0035 %/min.
w = moisture content 7 %Assume: Soil properties for Mixed grained sand Specify from
Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn,
John Wiley Press, 1974)Porosity: $n =$ 0.35Unit weight (dry): $\gamma_d =$ 1.72Void ratio: $e = n/1-n =$ 0.54Specific gravity: $G =$ 2.65Calculate A = Air filled volume (V_a)/unit wt.

Solving for 1 liter of soil

a) $V_v = n * 1 L$

$V_v =$ 0.35 liters V_v = void volume

b) $S_r = Gw/e$

$S_r =$ 0.34 S_r = degree of saturation

c) $V_w = S_r \times V_v$

$V_w =$ 0.12 liters V_w = volume of water

d) $V_a = V_v - V_{ww}$

$V_a =$ 0.23 liters V_w = volume of water

e) Bulk density = $\gamma_d + (V_w \times \gamma_w) =$ 1.8 kg/l soil

f) $A = V_a / \text{Bulk density} =$ 0.128 l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times 525,600 \text{ min/yr} =$ 902 mg TPH/year

EGLIN AFB (EG2) - INITIAL - MPC-D(39)

Biodegradation Rate Calculations

Formula: $K_b = K_o \times 1/100\% \times A \times D_o \times C$ Where: K_b = fuel biodegradation rate K_o = O₂ utilization rate (%/min.)

A = volume of air/kg soil

 D_o = O₂ density 1340 mg/LC = Carbon/O₂ ratio for hexane mineralization = 1/3.5Test Results: K_o = max. observed rate %/min.
 w = moisture content %Assume: Soil properties for Specify from
Table 1.4 (Ref. Foundation Engineering, Peck, Hanson, and Thornburn,
John Wiley Press, 1974)

Porosity:	$n =$	<input type="text" value="0.30"/>
Unit weight (dry):	$\gamma_d =$	<input type="text" value="1.86"/>
Void ratio:	$e = n/1-n =$	0.43
Specific gravity:	$G =$	2.65

Calculate A = Air filled volume (V_a)/unit wt.

Solving for 1 liter of soil

a) $V_v = n * 1 L$

 $V_v =$ liters V_v = void volume

b) $S_r = Gw/e$

 $S_r =$ S_r = degree of saturation

c) $V_w = S_r \times V_v$

 $V_w =$ liters V_w = volume of water

d) $V_a = V_v - V_w$

 $V_a =$ liters V_w = volume of water

e) Bulk density = $\gamma_d + (V_w \times \gamma_w) =$ kg/l soil

f) $A = V_a / \text{Bulk density} =$ l air/kg soil

$K_b = K_o \times 1/100\% \times A \times D_o \times C \times 525,600 \text{ min/yr} =$ mg TPH/year